EXECUTIVE DOCUMENTS

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THE HOUSE OF REPRESENTATIVES,

DURING THE

SECOND SESSION OF THE THIRTY-NINTH CONGRESS,

1866-'67.

IN SIXTEEN VOLUMES.

WASHINGTON:
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1867.

INDEX

TO

THE EXECUTIVE DOCUMENTS

OF THE

HOUSE OF REPRESENTATIVES OF THE UNITED STATES,

OF THE

SECOND SESSION OF THE THIRTY-NINTH CONGRESS.

PLATE I.

DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

J. W. STOKES, *Acting Commissioner.*

39TH CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 107.

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1866.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1867.

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ILLUSTRATIONS

REPORT

OF THE

COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 20, 1866.

SIR: I have the honor to submit, and take pleasure in presenting, this my fifth annual report of the operations of the department under my charge, hoping it will meet your approval, and that of enlightened agriculturists generally. And though the past year has been one of great care and labor, attendant on the continued transition of the nation from a state of war to one of peace—a year during which immense armies have been undergoing transformation into civic and domestic forces, and four millions of slaves have assumed their new and untried relations as free men—a year, therefore, involving disturbances inseparable from all such great changes—yet, thanks to the Divine overruling wisdom and goodness, and the judicious administration of those in charge of these changes, fewer difficulties and less extensive evils have been experienced than would have occurred in any other nation or under any other form of government. Our people, self-educated and self-governed, and accustomed to exercise their intelligence and freedom under written forms of law, have proved themselves capable not only of enduring the severest trials of a gigantic civil war, but also of passing peacefully and quietly through the most demoralizing changes which a transition from such a war to a state of peace could precipitate upon us. Some of these changes have been more wonderful than the suppression of the rebellion itself. But the changes which I fervently believe are yet to follow will probably be more wonderful, though less sudden and immediately apparent, and far more beneficent, because involving no destruction of interests, no sudden transitions, or sufferings, in classes or individuals.

Already favored by propitious Providence in giving us genial seasons, our farmers are laying widely and deeply the firm foundations of a new and increasing national prosperity. And as their peaceful conquests are extended the scars of earth made by devastating war will be effaced, and the heavy burden of debt which it piled upon the shoulders of our people will be gradually lightened, and finally and surely lifted.

The agricultural condition of the northern States was never more flourishing. High prices, accessible markets, and crops of average abundance, have insured good profits; and, as a result, mortgages have been paid, farm buildings erected, permanent improvements accomplished, farm implements and machinery obtained, and, in thousands of instances, a surplus invested in government funds.

Now that agricultural restoration has commenced in States lately in rebellion,

and efforts tending to amelioration and accumulation have already begun to produce their fruits, and to dispel the despondency which last year brooded over the industry of that region, it is sincerely hoped that improvement and progress will steadily mark the course of southern agriculture and secure a prosperity unequalled in the past, and unsurpassed by that of any other States of the American Union.

In the reorganization of industry in these States it is believed that the great mistake of the past, the concentration of labor mainly upon a single branch of a single grand division of productive industry, will be avoided. This mistake has cost that section one-half the wealth it might have attained, and may have led to the sacrifice in war of a portion of the remainder. Excessive increase of a single product, tending to over-supply and reduction of price, and attended with heavy expense for outward freights, and the purchase of all farm and family supplies burdened with cost of carriage and a long line of consuming commissions, points unerringly the way to national poverty and individual bankruptcy. A proper equilibrium of the products of industry, saving untold burdens of freightage, excessive profits and extortions of middle-men, insurance, breakage, and manifold losses, prevents reduction of prices from burdened markets, lightens damages from failures of single products, gives employment to all classes, conditions, and capacities of labor, insures remunerating wages for the workmen, renders possible necessary rotations and the production of farm manures, and increases the wealth, intelligence and power of a State. In political economy the smaller products of a diversified industry are far more than an equivalent for a single result of organized labor, however absorbing or important. The cotton crop, for example, of the empire State of the South, in 1860, was 701,840 bales, yielding little more than $30,000,000, while the butter of New York in 1865, one of several products of the dairy, was estimated at $60,000,000; and yet the census gives to New York but 370,914 farmers and farm laborers, and to Georgia, including white farmers and farm laborers, and only the males of the slaves, 316,478 persons engaged in agriculture. Besides the other dairy products, milk, cream, and cheese, and the multitude of smaller products of the farm, the principal crops make an astounding aggregate—as in 1864, when the corn crop of New York was estimated at $38,000,000, the wheat at $25,000,000, the oats at $33,000,000, potatoes at $19,000,000, and hay at $90,000,000. Including the minor cereals, products of orchards and gardens, the production of beef and mutton from pasturage, and a great variety of miscellaneous and exceptional products, the currency value of the agricultural productions of this one State in that year was far greater than the money returns of any cotton crop ever produced in the country, and the gold value of such products would be more than equivalent to the gold value of half the cotton crop of 1860.

It is evident that the diversification of farm industry, which secures these results in one location, must be applied to reorganized southern agriculture, with modifications such as climate and soil may indicate; and while cotton, as is hoped and believed, will ever be a prominent crop, and a sure reliance for immediate cash returns, it will never again overshadow and dwarf other interests essential to permanent success in agriculture. And it is also equally apparent that a portion

of the labor of these States will eventually be diverted from agriculture and expended upon other departments of industry, especially manufactures; and that the day is not far distant when a portion of this cotton will be exported from the States in which it is grown in the form of yarns and coarse fabrics of various grades and styles. And such a day will bring surer prosperity and more abundant wealth than ever blessed those States in the past.

The necessity of the introduction of improved farm implements in southern husbandry is imperative. Year by year, in western farming, has the economic value of labor-saving appliances been cumulative. The increase of such machinery since 1860, and the labor and money saved by it, are enormous. That which was to the west a necessity, from scarcity of labor and high wages, has become equally indispensable to the south, from the same considerations. The difficulty of keeping down superabundant growths of grasses and weeds, in the early part of the season, and of picking the cotton in the later months, affords opportunities for the employment and invention of machinery which should prove an incalculable benefit to cotton production.

The interests of agriculture in the southern States, so injuriously affected by the events of the past few years, demand the special attention of this department. The deterioration of sugar-cane, a tendency to which in the best varieties is strongly marked, has progressed rapidly since 1860, and a new importation of the *ribbon*-cane of Java is a desideratum of future success in "sugar-planting" in the Lower Mississippi valley. It might be well, also, to import some of the best varieties of Egyptian cotton, for experiment in the gulf States.

The want of information, supplied by the regular series of agricultural reports of this department, is severely felt in this section of the country. Calls are continually made for these documents, which I am unable to supply. Anxious inquiry is made for the improved processes of the more diversified interests of northern agriculture, and for the means of more economical production of the old staples; and it is for Congress to consider whether the interests of the nation may not be subserved by the republication of small editions of these reports, from the original stereotype, to supply this manifest want. I, therefore, hope for your recommendation that Congress may favorably consider and generously aid this department in its increasingly arduous labors to extend, supply, and improve the great interests of agriculture, on which depend so largely the prosperity of the people and the welfare of our whole country.

Frequent complaints are made that the most valuable seeds and the annual reports of the department sometimes find their way into inappreciative and even more improper hands, while hundreds who desire and would utilize them are deprived of them. This evil (for any waste of the expense incurred by the government in procuring seeds and preparing documents for distribution is truly an evil) may be unavoidable; it is certainly not remediable by this department; but it is humbly submitted that if Congress would provide that a considerable portion now distributed to individuals by its members should be divided among the State, county, and local agricultural and horticultural societies, the evil would be greatly lessened. Not only so, but such a distribution would encourage the formation and yield material support to such associations, making them the agents

of government in dispensing such favors, and rendering it the interest of farmers to connect themselves as active members with such organizations.

This department has steadily endeavored to secure a judicious and most useful distribution. It has supplied, so far as it could, all those, and those only, supposed to be really desirous of cultivating the seed and reading the documents, and then dispensing to others the benefit gained thereby. It requires that persons applying for them shall do so in person or by letter. It sends none to private individuals for distribution. It is restrained by want of means from supplying liberal quantities even to agricultural societies. It has been my constant desire to make the county societies the centres with which smaller local associations should co-operate; and the State societies the great centres of communication and diffusion for the county associations; and this department, the national head, to which all the State societies should communicate whatever they deem valuable and interesting, and from which might be most effectually distributed, these favors of the government. Thus far but little success has attended my efforts in this direction, principally because of the want of a thorough inter-organization of these various societies themselves; many of the State and county societies being fluctuating in their operations, and not a few having only a precarious existence. My exertions will, I trust, prove more effectual now that peace and returning harmony and prosperity invite the farmers to renew their social and co-operative efforts to improve their favorite pursuit.

The suggestion in my last annual report, of the pressing necessity of stringent legislation prohibiting the importation of cattle and hides, was promptly acted on by Congress, and the country has enjoyed entire immunity from a scourge which has destroyed, in the past, many millions of European cattle, and which has swept away between two and three hundred thousand British cattle in a few months of the years 1865 and 1866. It is to be regretted that there is no general provision for immediate measures of repression, with which alone the dreaded cattle plague has been promptly extirpated in other countries, to meet the case of its possible invasion and rapid spread. The six months' delay of the British government, in 1865, costing many millions of dollars, and the instant action of France, in two separate cases of invasion, stamping out the disease with trifling loss, are important lessons for our guidance.

The distribution of seeds has been larger than that of last year, amounting to 992,062 packages, an increase of 222,831 packages. The number delivered to members of Congress was 407,793 packages, an excess of 172,848 over their supply of last year; and 162,664 packages were sent to agricultural and horticultural societies, and 421,605 to regular and occasional correspondents, and in answer to personal application.

The propagating garden is now in successful operation. The distributions embraced 34,000 plants during the year. These consisted principally of the small fruits, such as strawberries, grapes, currants, raspberries, &c.

The area of this garden is too limited to be available for any other fruits than those above mentioned; but all new varieties of such are early procured, the process of testing their respective merits zealously pursued, and the results disseminated for general benefit.

A new feature has of late been introduced, that promises to be of much value, viz: that of furnishing examples of culture and arrangement, such as the "orchard house," the "tropical fruit house," "specimens of hedging," "arrangement of plants," and objects of similar import. It is proposed still further to extend this by introducing the "orangery;" a collection embracing plants used in medicine; also those whose products are employed in the manufacture of fabrics. These would form a museum of growing plants, and also provide a nucleus for a botanical collection, which will undoubtedly, sooner or later, be considered as an indispensable auxiliary to this department.

Considerable attention is still being given to the native grape, both with reference to its use as a table fruit and for wine-making purposes. Nearly one hundred varieties have already borne fruit and been reported upon, many useless sorts discarded, and the most valuable more prominently brought into notice.

In distributing the products of this garden my aim has been to disseminate varieties through those localities and climates most suited to their growth.

Observations taken during the period of testing are of great assistance in determining such habits and peculiarities as are known to be requisite for certain climates, thus enabling me at once to distribute with most encouraging hopes of success.

The operations and experiments of the experimental farm, though initiatory, and necessarily incomplete, have been interesting and suggestive. They abundantly warrant the most careful future management of the department, and the most ample facilities which the judicious and fostering care of the government may provide. By such means alone can the requirements of the law relative to testing seeds of foreign growth, prior to distribution through the country, be properly met.

Of fifty-five varieties of winter wheat grown, there were six worthy of particular remark. The Premium White Mediterranean, sown October 9, was harvested June 29, and produced forty-eight bushels per acre. The Red Bearded Mediterranean yielded nearly at the same rate. Both proved of fine quality, and are recommended for general cultivation. The Tappahannock and Russian "Scheffel" wheats succeeded admirably. Experiments will be continued during the present year upon the same varieties. Nine kinds from Glasgow and eight from the Royal Agricultural Exhibition at Vienna have been sown the present autumn. With the latter came one hundred varieties of seeds of cereals and vegetables, from the same exhibition, which will also be tested.

Sixty-seven varieties of spring wheat were sown, of which forty-six did well. The best success was attained by the Oregon; Red Bearded, or April, from Great Britain, (sown March 23, and harvested July 7;) Arnautka Hardy Spring, (sown March 24, and harvested July 7;) and several varieties from Germany. The Red Chili and Black Sea are worthy of special commendation.

Of the sixteen kinds of rye cultivated, Probstier and the Tirnia (from Saxony) are considered the best.

Seventeen varieties of oats were sown. The White Swedish, Yellow Lithuanian, Black Tartarian, Black Prussian, and Nun's, succeeded best.

The Oderbruch barley, from the low but drained lands in the valley of the

Oder, celebrated among the porter brewers of the continent of Europe, was cultivated under unfavorable circumstances, being received too late for a proper test. Other kinds were tried, with fair results.

Four varieties of sorghum were cultivated successfully, one of which, from China, analyzed by the chemist, yielded seventeen ounces of clear juice from three pounds of stalks.

From seventy varieties of peas, all did well except a few from Germany. The earliest were Dixon's First and Best, Wheeler's First Early, Sangster's No. 1, and McLean's Little Gem, the latter a prolific, green, wrinkled, marrow pea, growing about fourteen inches high. McLean's Epicurean, McLean's Princess of Wales, and McLean's Premier, proved to be fine flavored and prolific, while Saxton's Prolific, Yorkshire Hero, and Magdeburg Gold, gained an enviable reputation as second-crop peas, coming in soon after the earliest varieties. These early and second-early peas are preserved for distribution.

In experiments with the clovers, the Alsike proved very satisfactory, growing with rank luxuriance in this climate, and remaining green and succulent to a late period in the season. It has been cut three times, and at the present writing (November 15) presents a fine appearance. The Lucerne was also grown with good success. The Esparset proved its remarkable adaptedness to the lighter soils. Experiments are in progress with a great variety of grasses, the results of which will be given hereafter.

Of potatoes, from Great Britain and the continent of Europe, as well as the best new varieties of this country, the Orono, Samaritan, and Early Goodrich, all of them native seedlings, proved worthy of standing first on the list.

A great number of melons, squashes, onions, and other vegetables were tested, with interesting and profitable results. A watermelon from China is worthy of especial mention, together with a great variety of other Chinese vegetables. The Silver Skin Buckwheat, from Germany, is deemed to be of especial promise, and has improved in a second sowing.

A considerable amount of seed of approved varieties has been saved, and will enter into the general distribution, saving an expenditure of no small magnitude.

During the year past the interest in the subject of entomology, as connected with agriculture, has very much increased throughout the country, as has been evident from the numerous letters and insect specimens received. These letters have all been promptly answered, and the insects carefully preserved, together with the substances on which they feed. If proper cases could be provided in which to arrange and exhibit these specimens to advantage we should soon have a most interesting and instructive collection, and one which would be of great value to naturalists as well as to agriculturists.

The museum of the department, which is also under the charge of the entomologist, is, as it was last year, very much cramped for want of room, and no funds having been appropriated to carry it on, very few specimens of natural history have been added to it since the last report. The skins of birds and animals, which have been kindly donated, have not been mounted for want of means to have them done properly, but are carefully kept until the department may be able to have them put up.

Some valuable specimens of fibres have been received, the most important of which is the China Grass, or Bœhmeria nivea, a complete series of which, from the raw material to the manufactured fabrics, has been contributed by manufacturers in England. It is a fibre of great beauty and strength, and the plant, it is believed, being native of a warm climate, might be introduced with advantage into the southern States. It has succeeded well in the garden of the department, by taking up the tubers in the autumn, and might be grown to advantage in higher latitudes by a similar mode of treatment.

Two mounted specimens of the Angora goat have been added to the museum, together with samples of the wool and various fabrics made of the same. The importation and breeding of these animals have attracted much attention in certain sections of the country; their fleeces command a high price, and the value of their manufactures would seem to warrant the encouraging attention of the department.

Type specimens of the different sorgo and imphee seeds, classified and arranged according to a diagram prepared by the botanist, are kept in the museum for the purpose of reference and comparison. Some very fine samples of sorghum sugar have been received from the western States, where the cultivation of the plant and manufacture of its products seem greatly on the increase.

California has contributed some thirty bottles of native wines, with samples of the soil on which the vintage is grown, and over one hundred varieties of California vegetable seeds and other interesting products.

The necessity of urging Congress to make an appropriation for the purchase of the entomologist's collection is again pressed upon your attention, as it is of the greatest importance to continue the work by adding to the models of fruits already made those of new and important varieties, in order that the many calls for lists adapted to different States may be promptly met. The present inability to supply these demands is a cause of much embarrassment.

In the laboratory a large number of analyses have been made, and numerous assays of iron, copper, and silver ores; examinations of ochres, quartz, and metamorphic rocks for industrial purposes; determination of the amount of oil in petroleum, shale, and crude components of distillation.

Some examinations of grapes and domestic wines, and of plans susceptible of forming the basis of a wine manufacture, have been made.

The examination of maple sap and the expressed juice of sorghum has occupied much time. The varieties of sorghum used were those grown in the experimental farm of this department, from seed of recent importation from China.

These new varieties, four in number, were submitted to a series of experiments, with a view to determine the value of each variety so far as regards the capability of producing sugar in the crystallizable form and their consequent application in the manufacture of that article. The particulars are not necessary to give in detail here; it may be stated, however, that the result showed that these varieties yielded small amounts of crystallizable sugar, but the quantity of sirup yielded was large and of excellent quality, and these varieties rank, therefore, very high, and are useful additions to the numerous varieties of sorghum at present in use. One variety, especially, of these four, is deserving of particular attention on this account.

It is very desirable that this laboratory should be devoted to the prosecution of an extensive series of analyses upon growing crops useful for food or manufacture, and steps have been taken to connect it more closely with the experimental farm and garden, by the examination of certain crops at every successive stage of their growth, to determine their exact chemical composition from week to week until fully ripe, carefully noting the character of the soil, manures, and variations of heat and moisture, climate and winds—conditions which are continually altering the constitution of the plant. An amount of information capable of aiding in the culture of the plant will thus be obtained with more accuracy than when performed by agriculturists on their own lands.

To carry out these experiments on a scale commensurate with the importance of such labor, and the great extent of country interested in such results, more room is needed for the laboratory; two rooms, each of larger size than the one at present occupied are required. It is injurious to fine chemicals and instruments of precision to be subjected to the corrosive vapors and varying temperature of a laboratory of one room. It is desirable that more ample and suitable accommodations should be enjoyed at the earliest possible day.

A reference to the condition of the crops of 1866 may properly be made at this time, though it is too early to obtain complete returns of corn and cotton and a few other products.

The regular monthly crop returns of the statistical division of this department have hitherto included only the States east of the Rocky mountains and north of Virginia, Tennessee, and Arkansas. Hereafter all will be included, except the Pacific States, from which returns cannot be received in season to go into current monthly exhibits with the other States. Due attention will be given, however, to the collection of agricultural statistics of these new, productive, and progressive States, with their peculiar and exceptional industries, from which so much is expected in the future development of the country's resources.

The wheat crop of 1863, in the twenty-two States reported, was very large; in 1864 the estimate was, in round numbers, 13,000,000 bushels less, or 160,000,000; in 1865, 148,000,000; and the present estimate is still further reduced to 143,000,000. Returns from the eleven southern States, so far as received, warrant an estimate of 17,000,000 for that section. Texas has produced a large crop; the other southern States less than half the average product. The crop of the Pacific States is very heavy, leaving a far greater surplus for export than the entire amount of the crop of 1860. From all the data received in the department, the total amount of wheat produced in 1866 may be estimated at 180,000,000 bushels. The crop of 1859 was 173,000,000, and that of the present year, at the ratio of increase from 1850 to 1860, should have reached 242,000,000. The supply is about five bushels to each inhabitant, or half a bushel less than in 1859.

The corn crop is moderately large in quantity, but deficient in quality, and may be estimated at 880,000,000 bushels—about 40,000,000 more than that of 1859. It would have been an excessive product but for the retarding influence of cool and rainy weather, and the consequent damage by frosts. In some southern States a very small yield is reported, while in Texas the quantity is more than

an average. In the northwestern States the injury from early frosts was severe. While there will be a sufficiency of food for man, the supplies for the domestic animals will be unusually abundant. The hay crop, slightly deficient in some sections, is large in others, and of more than average quality; and the estimated total product of oats is sixty per cent. greater than in 1859. The products of gardens and the yield of potatoes and other roots are also in excess of former years.

The cotton crop has suffered from labor derangements, alternate rains and droughts, insects, and the previous neglected condition of the lands. Before the picking commenced, the indications, from official data, pointed to somewhat more than one-third of the crop of 1859. Ravages of insects and other causes have since rendered probable a reduction to 1,750,000 bales of 400 pounds each.

A special effort has been made to secure an estimate of the farm stock of the south for 1866. Returns have been sufficiently full to warrant a preliminary estimate with some degree of confidence, which would give a result in comparison with the census of 1860, as follows: Horses, 68 per cent.; mules, 70 per cent.; cattle, 65 per cent.; sheep, 80 per cent.; hogs, 56 per cent. These estimates for States are as follows:

States.	Horses.	Mules.	Cattle.	Sheep.	Hogs.
Alabama	82,591	67,012	409,934	307,229	909,127
Arkansas	79,913	38,450	232,797	93,266	316,340
Florida	7,530	6,873	256,119	6,031	108,696
Georgia	71,924	60,641	583,411	384,463	1,425,281
Louisiana	33,842	54,139	227,059	90,626	272,845
Mississippi	67,015	63,112	401,449	282,105	812,367
North Carolina	99,436	33,916	496,476	399,126	1,261,753
South Carolina	48,675	35,567	315,201	270,880	482,889
Tennessee	296,887	69,489	382,365	510,389	1,079,767
Texas	293,128	60,167	3,111,475	904,035	1,193,233
Virginia	172,547	28,710	543,122	761,586	959,951
Total	1,183,488	518,076	6,959,408	4,009,736	8,822,249

The following is a summary of department estimates of farm stock, in January of each year for two years past, for the northern States east of the Rocky mountains:

Stock.	Number.		Value.	
	1865.	1866.	1865.	1866.
Horses	3,740,933	3,899,019	$302,425,499	$326,885,813
Mules	247,553	250,151	25,041,488	25,039,839
Cattle	12,840,721	12,674,968	396,808,357	483,859,837
Sheep	28,647,269	32,695,797	154,807,466	146,425,697
Hogs	13,070,887	13,616,876	111,796,318	120,673,158
Total	58,547,363	63,136,811	990,879,128	1,102,884,344

The following is the department estimate of the amount of the following principal crops, their average and total value in the northern States, embraced in current crop estimates of the past three years:

Estimated amount of crops.

Cereals, &c.	1863.	1864.	1865.	Increase in 1865.	Decrease in 1865.
Indian corn, bush..	397,839,212	530,451,403	704,427,853	173,976,450	....
Wheat ....do...	173,677,928	160,695,823	148,522,827	....	12,172,996
Rye ....do...	19,989,335	19,872,975	19,543,905	....	329,070
Oats ....do...	170,129,864	175,990,194	225,252,295	49,262,101	....
Barley ....do...	12,158,195	10,716,328	11,391,286	674,958	....
Buckwheat ..do...	15,786,122	18,700,540	18,331,019	....	369,521
Potatoes.....do...	98,965,198	96,532,029	101,032,095	4,500,066	....
Total	888,546,554	1,012,959,292	1,228,501,280	228,413,575	12,871,587
Tobacco..pounds..	163,353,082	197,460,229	185,316,953	....	12,143,276
Hay.........tons..	18,346,730	18,116,691	23,538,740	5,422,049	....

Estimated average of crops.

Indian corn, acres..	15,312,441	17,438,752	18,990,180	1,551,428	....
Wheat ....do...	13,098,936	13,158,089	12,304,894	....	853,195
Rye ....do...	1,439,607	1,410 983	1,396,123	....	14,860
Oats ....do...	6,686,174	6,461,750	6,894,091	432,341	....
Barley ....do...	557,299	540,317	542,175	1,858	....
Buckwheat ..do...	1,054,060	1,051,700	1,057,084	5,384	....
Potatoes ....do...	1,129,804	902,295	964,614	62,319	....
Tobacco.....do...	216,423	239,826	236,363	....	3,463
Hay........do...	15,641,504	15,034,564	16,323,852	1,289,288	....
Total	55,136,248	56,238,276	58,709,376	3,342,618	871,518

Estimated value of crops.

Indian corn......	$278,089,609	$527,718,183	$324,168,698	....	$203,549,455
Wheat..........	197,992,837	294,315,119	217,330,195	....	76,984,924
Rye.............	20,589,015	31,975,013	21,343,283	....	10,631,730
Oats...........	105,990,905	139,381,247	93,745,314	....	45,635,933
Barley..........	13,496,373	16,941,023	10,330,294	....	6,610,729
Buckwheat	12,660,469	21,986,763	18,063,325	....	3,923,438
Potatoes.........	25,024,650	77,184,043	65,218,428	....	11,965,615
Tobacco.........	24,239,609	29,335,225	23,348,013	....	5,987,212
Hay	247,680,855	365,707,074	273,812,617	....	91,894,457
Total value..	955,764,322	1,504,543,690	1,047,360,167	....	457,183,523

The meteorological portions of the reports of this department, at first objected to by many, are beginning to be widely appreciated. The connection of that science with agriculture is clearly perceived by intelligent farmers; and the frequent references to and use of meteorological phenomena by the best agricultural writers is drawing attention to and increasing general interest in the details these

observations reveal. A further acquaintance with the already known laws of the science will enable us to remedy many evils which depend on atmospheric causes. But more particularly will information on meteorological changes, gathered from many points and for a number of years, prove highly important and beneficial when extended and national efforts are made, as I trust they soon will be, to plant large belts and forests of timbers and extensive shelters of forest trees on the prairies and deserts of our public lands. Not only agricultural productions, but the comforts and appliances of civilization and even population itself, over a great length and breadth of the national domain in the west, will be found to be dependent on such belts and shelters, as the shelters themselves will be dependent for efficiency on the proper application of meteorological principles in their location and propagation.

It is, therefore, deemed important that this department should continue to publish, monthly and annually, the most immediately valuable and interesting portions of the observations furnished to the Smithsonian Institution for the use of the farming interest. I have, therefore, continued the arrangement made with that institution, by which the first use of the monthly reports made by its numerous observers is obtained by the department. This arrangement saves the expense of a double set of observers, and is a mutual advantage. The observers, like the regular monthly correspondents of the department, serve without pay, from interest in the labor and a generous public spirit; and the department, therefore, includes them among those to whom it regularly distributes its documents and seeds of most valuable vegetables, flowers, and cereals. As the most of these observers are personally engaged, more or less, in raising fruits and vegetables, they are among the best persons to whom such a distribution could be made.

Since making my last report, I have returned to Congress the trust confided to my care relative to improvements in processes for preparing flax fibres for manufacture, and to the treasury of the United States the sum of $10,500, the unexpended balance of the appropriation for that purpose. While complete success in cottonizing flax was not obtained, practical results of great economic value have been accomplished, and improved fabrics have been placed in the market by manufacturers who have been most successful in their experiments, and who are still continuing their efforts in that direction.

The balance of the appropriation for the service of the fiscal year ending June 30, 1866, remaining unexpended on the 1st of December, 1865, was $98,584,81. There was appropriated for the fiscal year ending June 30, 1867, $149,100.

The expenditures from December 1, 1865, to November, 1866, amount to $162,600 43, leaving an unexpended balance of $85,084 38.

I desire to renew my acknowledgments to United States consuls in foreign countries for continued favors of great value to this department, and to express my appreciation of the courtesy of the Secretary of State in forwarding promptly the correspondence, official documents, and statistical data received from foreign sources. Similar acknowledgments are due to intelligent and public-spirited

gentlemen of all portions of the country for their enlightened co-operation and disinterested services.

In closing, I cannot repress the conviction that a new era is dawning upon the agriculture of our country, in which intelligence and progress will cheapen production and enhance the wealth and increase the happiness of the people.

ISAAC NEWTON,
Commissioner of Agriculture.

His Excellency ANDREW JOHNSON, *President*

REPORT OF THE SUPERINTENDENT OF THE EXPERIMENTAL GARDEN.

SIR: I have the honor to submit the following notes and observations on various subjects connected with the garden:

STRAWBERRIES.

The best soil for strawberries is a clayey loam. As a rule the foreign varieties are not profitable on light sandy soils, unless they are well enriched and heavily mulched during summer.

Previous to planting, the ground should be prepared by deep working and heavy manuring; if immediately preceded by a potato crop, the soil will be left clean, and it has been proved the best rotation.

To produce best crops plant singly, not closer than eighteen inches in garden culture; in field culture rows may be three feet apart, and plants from fourteen to sixteen inches in the rows.

Keep all runners down, as well as weeds, during growth. Stir the ground when necessary after the crop is removed. If possible do not allow any surface stirring from the beginning of September until after the crop is gathered, so as not to disturb the roots formed during that period, as they are essential to the plants while fruiting.

Protect the plants in winter by slightly covering with straw or long manure. Even the hardiest and most robust varieties will show an extra produce when thus sheltered from the drying action of frosty winds.

There is no danger in having the soil too rich when the runners are constantly removed and the plants kept distinct.

A plantation set with good runners in September will give a fair crop the following summer.

The Jucunda and Triomphe de Gand are not yet excelled on soils suited to their kinds.

The Agriculturist proves to be a fruit of much value, large berry, and flavor very good. The plant is also quite productive.

Russell's Prolific is a very fine flavored berry, of good size. Plants only moderately productive.

New Jersey Scarlet is very productive; fruit soft and deficient in flavor.

French's Strawberry proves unworthy of further attention here.

Golden Queen, as received, seems identical with Trollope's Victoria.

Lady's Finger is a profitable variety; fruit firm; flavor medium; best in a rather wet season.

Raising from seed.—Few fruit-bearing plants can be so early tested as the strawberry. The mode adopted here, in producing from seed, is as follows:

When the fruit is thoroughly ripened the berries are bruised and the seeds washed out, as far as practicable, from the pulp. This operation is facilitated by paring thinly the outer surface of the berry, which, of course, includes the seeds. By this means much of the pulp is rejected. When washed and separated they are laid on paper and dried. Well-drained, shallow boxes are filled with light sandy soil, firmly pressed to a level, smooth surface. The seeds are rubbed between the finger and thumb to separate them from the adhering pulp, and sown thinly. A slight sprinkling of sand is sown over them, and the whole

surface pressed carefully. Deep covering is to be avoided. The boxes are now placed in a shady position, such as the north side of a wall or hedge, and covered with boards during the day until the seeds vegetate. This covering prevents drying, and obviates frequent waterings, which have a tendency to disturb the seeds.

As soon as the young plants appear they require to be fully exposed at night, although still partially shaded from bright sun. Any direct covering during the night (except it is necessary to protect against heavy dashing rains) is injurious, causing the young plants to damp and decay.

As soon as true leaves are formed the plants are carefully separated and replanted, either in portable shallow boxes, or in a frame; soil similar to that used for the seeds. They should not be set nearer than two inches apart; the soil settled about the roots by watering over them through a fine rose or syringe. Shade for a few days until they commence growth. Never allow them to suffer for water, and allow them full exposure, both day and night.

About the beginning of September the plants will be ready for permanent planting. The soil being fully prepared and pulverized, set the plants in rows three feet apart, and allow eighteen inches from plant to plant. They will grow into good sized plants before frosts, and form numerous flower beds for fruiting the following summer. A slight covering should be given them during winter.

Managed in this way, fruit is produced in less than twelve months from the time of sowing the seeds; and, if the various details of transplanting, &c., have proved favorable to constant and uninterrupted growth, the crop produced will be quite large.

The quality of the fruit should not be determined by one year's trial; but the second year's growth and fruitage will exhibit the normal state of the plant, and until this is ascertained all runners should be carefully removed.

GRAPES.

For several years past the department has occasionally received packages of foreign grapes. Some of the varieties were accompanied with high recommendations of excellence, and all of them have received proper attention. Their fate has been the same that has befallen all other foreign grapes when grown in the open air east of the Rocky mountains—they are all dead.

It would seem that the experience of at least seventy years ought to suffice in this matter of the foreign grape. All attempts to grow them profitably in ordinary vineyard culture have failed; still there are those who cannot be convinced of this fact except by ocular demonstration. The circumstance that an occasional season occurs when their growth seems quite satisfactory, and also that in some peculiarly sheltered situations, such as in city yards, they sometimes produce tolerably fair crops, has a tendency to maintain a lingering hope of ultimate success; but, sooner or later, their fate is certain, and at no time can confidence be placed in their permanency.

A few years ago, when the Yeddo grape was imported from Japan, high hopes were entertained of at last possessing a foreign grape that would adapt itself to this climate. These hopes seemed reasonable. The climate of that country, in many respects, closely resembled our own, and our flower gardens and shrubberies were much indebted to it for their beauty and interest; but the Yeddo grape has proved a failure in field culture, and the fruit is not of sufficient worth to warrant its culture under glass.

It has long been a favorite idea with some that our only hope of ever improving our native grapes, so as to render them of particular value either as a table fruit or for the production of wine, is to hybridize them with the foreign species. Many pomologists, on the other hand, maintain that the true course is to persevere in producing seedlings from native varieties, hoping by this means to

secure a plant possessing the valuable qualities required, by one of those sudden changes that often occur, and of which physiology has given no explanation, although a process that has given us nearly all our best fruits and flowers.

Several reputed hybrids are now in cultivation, but none of them give evidence of great improvement, and, in some respects, their reputed origin is open to doubt.

Concerning native grapes I have but little to add to former reports. The Concord still maintains its place as the most useful. In some situations the fruit rotted considerably in July, owing to heavy rains; but the leaves are rarely injured by mildew, and, as a consequence, the wood is always well matured.

Ives's Seedling proves to be very hardy, and satisfactory as to growth. The fruit certainly cannot rank highly for table use, whatever value it may have for wine.

Allen's Hybrid proves to be tender, and wholly unreliable. The foreign grape element predominates too largely in this variety for it ever to become permanently valuable for vineyard purposes. Its habits have a close resemblance to the Golden Chasselas.

Iona is very liable to mildew, so much so that it seldom ripens any wood without summer protection.

Adirondack is also extremely liable to mildew. Under protection it grows very freely, and is the best early grape, but doubtful for general culture.

Israella is vigorous in growth, not so liable to mildew as some others, and is so far very promising.

Creveling succeeds very well, and produces fruit of a fair quality. Possibly its greatest fault is a disposition to set the berries thinly on the bunch.

Taylor's Bullitt cannot be considered as of much value for general uses, and, if discarded, the grape list would not feel its loss. The same remarks apply with equal justice to Franklin, Anna, and To-Kalon.

Maxatawny makes very poor bunches, and but few of them set well; and, although it is one of the finest flavored berries, it will not become popular.

Cuyahoga, like Rebecca, requires a somewhat sheltered, if not a shaded position, to attain perfection. Certainly the finest crops I have seen were on plants thus situated.

Christine is a good black grape, early, and worthy of attention.

Little Giant and Hamill's Seedling prove to be so near like Isabella, as not to show any distinguishing feature from that variety.

Mead's Seedling has the same relation as above to Catawba.

New Buda: a variety received under this name, proves to be Concord.

Clara, Canadian Chief, Clappier, Emily, Jacobi, and Brandywine are seedlings of foreign grapes, hence not reliable here.

Flickwir, same as Clinton.

PEARS.

The culture of the pear has long been of peculiar interest. The great excellence of the fruit, and its nearly continuous season of perfection—some late keeping varieties nearly meeting the earliest ripening sorts—and its great beauty as a tree, have always maintained its culture as one of the most refined.

Notwithstanding that it is one of the most anciently cultivated trees, the fruit is still scarce in our markets. Indeed, as a market fruit, the finest varieties are rarely seen, so that fine pears are but little known among the general public. This fact has often been noticed, and various reasons have been adduced, from time to time, for this scarcity. One prominent cause of failure is blight. In some sections this fatality is very prevalent, and materially retards extensive culture. Occasionally the crop is severely injured by late spring frosts destroying the blossoms, or heavy rains preventing a proper distribution of the pollen and setting of the fruit; all of which casualties tend to create a degree of uncertainty with regard to the economical culture of the tree in many sections of the country.

For many years the dwarf pear has been planted very extensively, and while a considerable amount of success has resulted, it cannot be denied that great disappointments have also been experienced, and that, too, in cases where a knowledge of tree culture was by no means of an inferior order. It is a common remark that dwarf pears are always successful under proper treatment. This may be so, but what *proper treatment* really is has not been very satisfactorily defined.

I have observed that in some plantations, considered successful, the most peculiar point of treatment consisted in immediately filling up blanks with healthy plants. Considering the small amount of first cost, this plan may be deemed worthy of special recommendation.

Dwarfing, in this connection, is merely a technical term, indicating that the tree has been *worked* upon a plant of weaker growth in order to hasten its maturity, a system based upon a well-known law in vegetable physiology. In order to effect this change in the pear it is grown upon the roots of the quince, and although, in the case of strong growing varieties, the desired object is undoubtedly secured, yet the indiscriminate use of the quince for all the varieties of pears will lead to disappointment, as many of the weaker kinds are thus enfeebled beyond general healthiness, which defeats the end in view.

The desire to produce pyramidal-formed trees has also had an effect prejudicial to quince stocks. The roots of this plant being rather small and fibrous, do not afford sufficient strength to support a tall, heavy foliaged tree; consequently, when heavy storms of rain and wind soften the soil and sway the tree, the roots are twisted or broken, and the tree laid prostrate. Injury from this cause may be greatly modified by keeping the plants low, in spreading bush fashion; so far as pruning will direct this form the same rules should be adopted as recommended for keeping a hedge—that is, the centre shoots should be shortened during summer, and the lower side shoots in winter pruning. When tall trees are shortened by removing the top branches, a point is formed for the emission of numerous small shoots, which should be frequently removed or pruned back, otherwise the centre of the tree will assume a thick set, hedgy appearance. The best mode is to commence with the young tree, and endeavor to have the lower branches proceed from as near the base as possible, spreading out uniformly round the stem, the upper shoots bending outward as in the form of a vase. There are some varieties, with strong upright tendency of growth, that cannot well be induced to present this form, but even these, if long shoots are encouraged, will gradually assume it, assisted as they will be by the weight of fruit on such branches, and when once this slightly pendant fruiting habit has obtained, no great difficulty will be found in maintaining it. If other modes fail, mechanical means may be used, such as tying down the branches to a ring of wire, fastened to the ground with pegs.

With reference to standard pears, those grafted on pear stocks, although perfectly able to support themselves against all ordinary storms, yet they also should be encouraged to branch low on the stem; grown, as they usually are, in the nursery, in close rows, the lower branches are rarely sufficiently developed; hence it is necessary to prune the tops rather severely at planting, in order to produce side shoots. When the foundation of the plant is thus fairly established, any further pruning should be carefully and rather sparingly performed; great mistakes are constantly made by supposing that a yearly pruning is a necessity. Instead of *shortening in*, as it is termed, the annual growths at winter pruning, fruiting spurs will be more certainly and much earlier developed by leaving the growths untouched. This winter-shortening of the previous year's growth results in increasing the number of slender shoots, a good practice for the production of basket-making material when confined to the willow, but a very useless one on the pear where fruit is the main object.

A collection of standard pear trees planted in the garden, spring of 1863, have not been pruned since the fall of that year, and some varieties have pro-

duced two fair crops. Many of them made yearly growths from four to six feet in length; no shortening in was allowed, and in consequence these long shoots speedily became studded over with fruiting spurs, and in due time with fruit. Referring to the beauty of the tree, under this mode of treatment, they will not certainly all show fine *pyramidal* heads, but for fine ornamental forms, some of the varieties—as Flemish Beauty, Lawrence, Baronne de Mello, Buffum, Urbaniste, and Howell—cannot well be excelled, especially when the additional attraction of a fair crop of fruit is taken into consideration. When a tree is transplanted, and has its roots more or less mutilated during the process of removal, common sense points to the propriety, and practice proves the necessity, of a judicious thinning of the branches; but when the balance of power between the roots and branches is again fairly restored, pruning, unless to rectify abnormal growths, is certainly of questionable utility. Several of the trees have suffered from blight. I know of no preventive of this disease. As soon as observed the diseased portions are removed; and almost all recover—at least, what is left, shows no symptoms of injury from contamination. Trees that were cut over within a few inches of the surface of the ground, a little over two years ago, are again showing signs of fruiting. It is seldom, however, that such severe cutting is required, individual limbs being more generally attacked.

RASPBERRIES.

All the large fruited and finer varieties of raspberries can only be produced to perfection by covering the canes during winter; this, however, is a simple matter. No plan is so effectual or so economical as that of bending the canes closely to the surface and covering them with a couple of inches of soil, the object being to prevent evaporation from the stems during dry, frosty periods. The whole of the canes should be covered. The hardiness of the canes is influenced by the soil upon which they are growing. In heavy or rich soils the growth is continued late, and, in consequence, are not always properly matured; a moderately rich soil is more favorable, so far as it affects the hardiness of the plant. Of the hardiest varieties the Philadelphia seems to be one of the best. A collection of sixteen varieties was left uncovered the past winter, and this is the only one that has produced a fair crop. Although not first-rate in flavor, its great usefulness must commend it. The Allen stood the winter very well, but it sets fruit so sparingly and so irregularly that it is not worthy of attention. Good crops have been produced by planting it in close proximity to perfect flowering kinds, but even this precaution will not always secure a crop, and as varieties of equal merit can, with proper treatment, be relied upon for regular crops, there seems to be no reason for increasing the Allen. With proper winter care, Brinkle's Orange, Franconia, Hornet, Falstaff, and Red Antwerp will give entire satisfaction.

BŒHMERIA NIVEA, OR CHINA GRASS.

Experiments with this plant have resulted in proving that it can be grown successfully here. In low or wet situations, or in undrained tenacious soils, the roots decay in winter; on well drained or sandy soils they will, in the majority of seasons, exist, but the mode of culture evidently most satisfactory is to dig or plough up the roots before severe frosts, and keep them in a dry cellar, or protect them in a pit similar to the practice adopted in preserving potatoes. To produce the best growth the soil should be deeply worked, only moderately enriched, properly pulverized, the roots planted and cultivated exactly similar to a potato crop. Of course, the details of culture will be modified as may be suggested by experience; this, together with the question as to whether its culture can be made profitable, can only be developed by experiment. Plants are easily produced from seeds; these are very minute, and will require to be sown, and the young plants treated in a similar manner to that adopted in raising the tobacco.

INSIDE BORDERS FOR GRAPERIES.

It has been strenuously advocated that the soil in which foreign grapes are grown should be wholly under the glass, and many of these structures have been so arranged, but not with successful or satisfactory results. There were two very distinct and seemingly weighty reasons urged by those who advocated this mode, first, that in the case of forcing houses it was essential to have the soil for the roots in the same temperature as the branches; and second, that in the case of cold graperies, when the borders are exposed, the roots are influenced by rains during the ripening of the fruit, retarding maturity and inducing rot in the bunches. These results may be guarded against by the use of inside borders; nevertheless, as ordinarily managed, they have proved failures. They are useful to a certain extent where early forced fruit is an especial object of culture. The plants will succeed for a few years very satisfactorily, and by a renewal of both plants and soil from time to time the practice may be sustained; but, in the management of what are termed *cold graperies*, the ordinary warmth of the soil is all sufficient; and as far as regards the second consideration, viz., the protection of the roots from heavy rains when the crop is attaining maturity, that may be secured by less costly expedients; light wooden shutters have been used for covering the borders, and when the surface is sloping a covering of leaves or straw will answer every purpose. The main reason for alluding to these borders here is for the purpose of noting that where it is practicable to remove the sashes or roof, so as fully to expose the border to the action of the weather for a period extending from the ripening of the wood until forcing again commences, it will tend to maintain the healthy action of the soil for a long series of years. Winter rains, snows, and slight frosts are all of great benefit, as has been fully realized with an inside grape border in this garden.

TREATMENT OF ORCHARDS.

Inquiries have frequently been made as to the propriety of cultivating apple and other orchards; these have mainly been put in the shape of a categorical question, viz: whether an orchard should be cultivated or kept in sod? These inquiries were answered as appeared appropriate on learning particulars; but, as the subject is interesting, a few general remarks upon it may be here introduced. The object in planting fruit trees is, of course, to produce fruit. That treatment will, therefore, be considered proper which maintains the trees in a healthy, fruiting condition; and whether, in order to maintain this required condition, it is necessary to cultivate the soil, or lay it down in grass, will altogether depend upon attending circumstances.

It is well known that manuring and stirring the soil are favorable to the growth of plants—both are necessary when the greatest vigor is required. It is also equally well known that the greatest vigor of growth is not always combined with the greatest productiveness; on the contrary, it is an indisputable fact that a tree cannot display great vigor of growth, and at the same time be correspondingly fruitful. The two processes are antagonistic, and cannot exist together. Here, then, is a principle for our guidance in determining the question as to whether an orchard should be cultivated or kept in grass sod. When trees are young it is well to encourage vigorous growth until they reach a proper fruit-bearing size, which they will speedily do in rich cultivated soil, provided that the yearly growths are perfectly ripened. In localities or climates where the growing season is comparatively of short duration, stimulating appliances cannot consistently be used to the same extent that would be perfectly justifiable where a longer season would enable even an exuberant growth to reach thorough maturity; this fact is not sufficiently understood or appreciated; at least it certainly is not taken into consideration by those who advocate the indiscriminate enriching and cultivation of orchards. There is a well established law in vegetable phys-

iology that will bear repetition, viz.: "That whatever tends to check vigorous growth in a plant is favorable to the production of flowers and fruit." We are acting in accordance with this law when we find an orchard has reached a fruit-bearing size, but gives no indication of a fruiting disposition, to lay it down in grass. Of all modes of checking growth in orchard trees this will be found the best; and if, in the course of time, appearances indicate the necessity of stimulants, they can be supplied in surface applications; and still further, if the trees become stunted in their growth and unhealthy, the soil can be ploughed and cultivated, the trees winter-pruned, and thus thrown into fresh vigor and fruitful health.

Therefore it is that the question of keeping orchards in sod, or in keeping them in a state of surface culture, depends entirely upon the state of the trees, as influenced by the nature of the soil and conditions of climate, always keeping in view that the principles governing vegetable growth are universally the same; but the practice that may be deduced from them will vary widely, according to circumstances. In questions of this kind it is impossible to give definite practical directions that will be equally applicable to all; the practice that would be suitable for one locality and soil would be unsuitable for another differently circumstanced. In view of the many conflicting opinions, which are unavoidable in the enunciation of merely practical rules, it is a question worthy of more than mere passing notice, whether more real progress would not follow from the promulgation of principles only, leaving every one to deduce and apply the practice that would thus be suggested; for it is well known that no amount of explanatory information will compensate for the want of that discriminating knowledge which is possessed by those who have studied the principles of vegetable growth.

SOWING SEEDS.

The department is in the frequent receipt of letters, wherein the writers complain of their inability to raise plants from the seeds distributed by it, as well as those procured from other sources. The cause of failure is at once attributed to the quality of the seeds, and the source from whence they were obtained is denounced for sending out a bad article. It is safe to state that good seeds are the rule, and bad seeds the rare exception. So far as the department is concerned, there is proof of their good qualities, as most of them are germinated, and the plants grown, here; and every respectable seedsman in the country uses all the precautions that experience and business competition suggests in order to secure seeds of the best quality. The truth is, that they fail to germinate because they are improperly managed; and of all the causes of failure, the most frequent is that of covering them too deeply with soil, where they either rot, owing to the excess of water and want of air, or the feeble germ is unable to overcome the weight of soil it has to move before reaching the light. The proper depth for each kind of seed must be judged by its appearance. The rule has been given to cover with a depth of soil equal to the diameter of the seed, which is probably as nearly correct and as definite as can be reached. The greatest difficulty is in the case of small seeds, which succeed best when merely scattered on the surface and pressed into the soil. In the moist atmosphere of a greenhouse or similar structure they will do very well; but when sown in the open air, expedients must be used, in order to keep the earth suitably moist, such as sprinkling the surface with chaff, moss, leaves, or straw, taking care to remove the covering immediately after the seeds germinate; this will also prevent the soil from becoming hard and compact, and thereby obviating another frequent cause of failure. It is also a fatal error to sow too early; the soil should be dry, friable, and warm, in order to excite germination and maintain an uninterrupted healthy growth. Unhealthy plants are sure to result when heat and moisture are presented in varying quantities to the tender germ.

Seeds that are enclosed in a hard shell vegetate most freely when sown as soon as ripe. For instance, seeds of the grape, if planted immediately when the fruit is ripe, will vegetate in a few weeks; but if kept dry until the following spring, and then sown, but few will vegetate until they have lain in the soil for twelve months.

HEATING A PROPAGATING HOUSE.

The following engravings of the propagating house in the garden are introduced for the purpose of showing the mode by which it is heated. The best and most economical mode of warming glass structures is a vital question in their management. It is almost unnecessary to repeat that the best mode of conveying heat is through the medium of water, but the cost of fittings heretofore considered requisite has prevented its more general adoption. The expense of boiler and pipes to heat a moderate-sized greenhouse is out of all proportion to the cost of the structure; and in addition, the great waste of fuel has to be taken into consideration. The common flue heater, again, as ordinarily constructed, although a cheaper arrangement, is deficient in the equal distribution of heat. A combination of these two modes, securing, in a simple manner, the superior distributing qualities of the one with the economical peculiarities of the other, is a desideratum of some value and importance. In a structure exclusively devoted to the propagation of plants from cuttings, it is essential to have the heating arranged so that, while the cutting bed is warmed, the temperature of the atmosphere is kept as cool as possible; in other words, the bed is warmed and not the air, except so far as the radiation from the bed will warm the latter, the principle being to keep the atmosphere so low as to prevent growth at bud, while the root-forming process is excited. In this instance, this is accomplished by heating a shallow tank of water, upon which the cutting bed is laid, as shown in the arrangement herewith presented.

Transverse section through furnace-pipe for heating water, main smoke-duct, showing also water channels of propagating bed in end view.

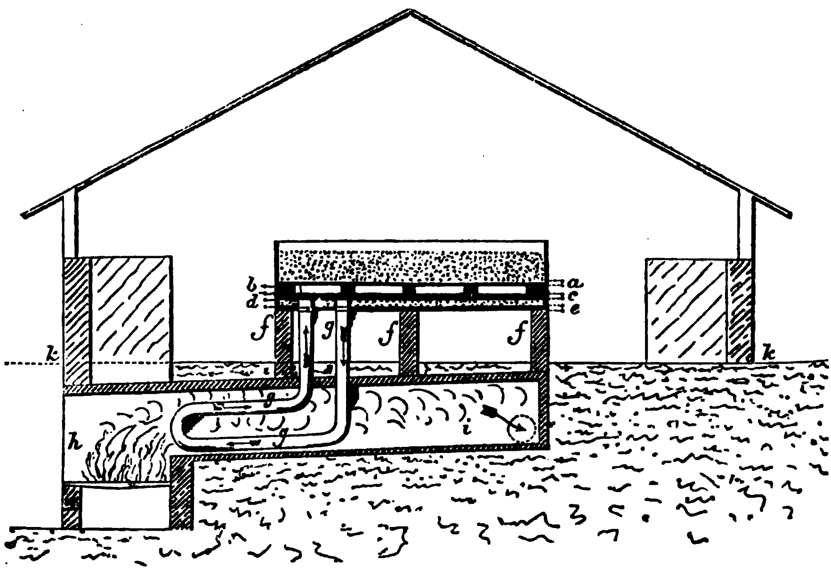

Fig. 1.

Ground plan, showing the water channels in section, and the smoke-pipe in top view.

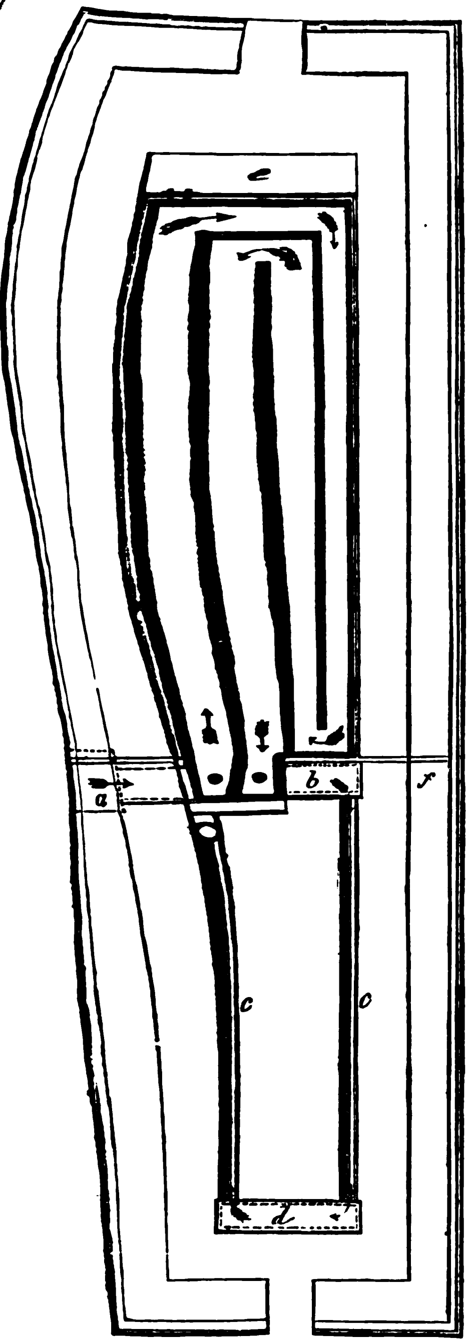

Fig. 2.

Showing position of terra cotta piping for flue, and brick check-flue at end.—(References same as Fig. 2.)

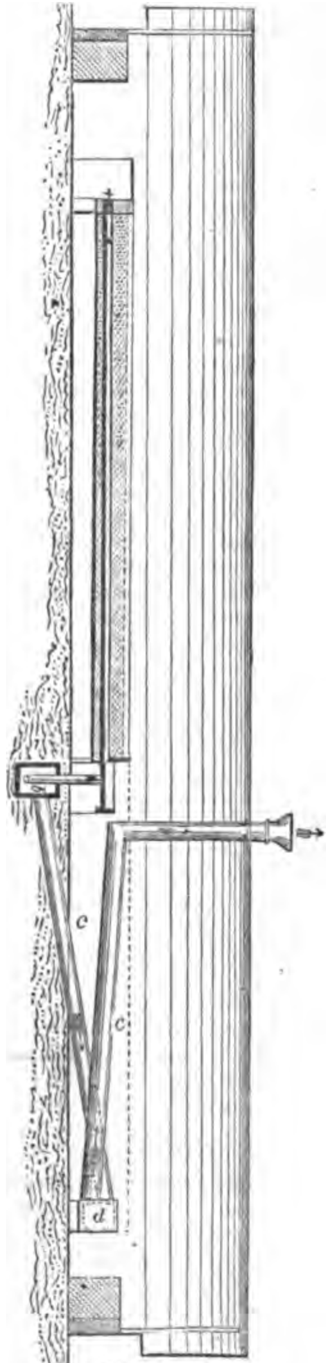

Fig. 3.

References to Fig. 1.—*a.* Common boards, one inch thick, covering tank; *b.* Space for water, two and one-half inches in depth; *c.* Bottom of tank, formed of brick, laid flat, covered with a layer of cement; *d.* Layer of three inches of sand, to isolate the brick-work of bottom from supporting board; *e.* Supporting board, two inches thick; *f.* Walls supporting bed; *g.* Four-inch cast-iron pipe, set in the fire-flue, communicating with and heating water in tank; *h.* Furnace; *i.* Flue; *k.* Level of ground.

It will be seen that the tank is heated by a pipe set in the flue, near to the back of the furnace, serving all the purposes of a boiler, if not more, inasmuch as it presents no obstacle to the further economizing or utilizing of the heat over that required to warm the water in the tank, a point in heating that is frequently neglected; for even the most improved form of boiler allows the exit of much heat at the chimney, whereas the waste of heat in this arrangement is reduced to a minimum degree.

References to Fig. 2.—*a.* Furnace; *b.* Flue; *c c.* Smoke channel of ten-inch terra cotta piping; *d.* Check-flue, eighteen inches in height, and the same in width, built with bricks on edge, and covered with thin slates; *f.* Glass partition.

It will be observed, in Figures 2 and 3, that the pipe-flue is checked in its course by a small section of brick flue (*d.*) It was found that a continuous pipe afforded too great facility for the transmission of heat to the chimney, where it was lost. On intercepting it in the manner shown, a considerable gain of heat was perceptible in the house. This mode of checking the escape of hot air will be found effectual, and, in connection with terra cotta pipes, may be repeated several times in lengthy flues with great advantage; these larger spaces, while they tend to check rapidity of draught, without interfering with the working of the furnace, also act as conservers of heat, and their extended surfaces increase the radiating capacity of the flue.

Another practical advantage of this mode of heating is its adaptability; a pipe may be inserted in any existing flue, and heat conveyed either to a tank or in pipes to any part of the house. In a small house here, used for the culture of exotic fruits, a short bend of inch-and-a-half iron pipe supplies heat to a tank-bed thirty feet in length, and eleven feet in width. This large body of water is easily maintained to an average of 110 degrees. The same furnace, in addition to heating the water, heats a house 60 feet in length by 25 feet in width, half of which is kept at a tropical temperature.

Again, it is a matter of some importance that all the mechanism required in making this simple heating-pipe can be furnished wherever there is a plumber or gas-fitter; its fitting up being so easily accomplished that no special mechanical talent is requisite.

The most economical arrangement in heating a house, by this combined hot-water and common flue, is to place the furnace near the centre of the structure, heating one end with water, with tiers of pipes, or tanks, and the other division with the flue; and it will be found that a greater amount of cubic feet of atmosphere can be heated by this combination than can be done by any other mode from the same amount of fuel, and the cost of its erection is cheaper than any other combining the same good qualities.

WILLIAM SAUNDERS.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

REPORT OF THE ENTOMOLOGIST.

SIR: Having given, in my reports for 1864 and 1865, a history of the foundation and object of the museum connected with this department, there is little to be said in regard to it at present, further than that it has been steadily progressing in interest, and that specimens have been accumulating till no space is found in which to arrange or exhibit them. The design now is, as soon as proper facilities are provided, to extend the plan of the museum so as to embrace three distinct divisions—a general, an economic, and a State collection. This last will be of special interest to individuals, as it will represent the principal products peculiarly adapted to the soils and climate of different States, so that one may be compared with another at sight, and farmers may feel a State pride in sustaining the character of local contributions. This spirit has already manifested itself, to a considerable degree, even in the imperfect attempts at classification our limited room has permitted.

The general division will contain everything that can be collected of use or interest to the farmer, beginning with the seed or germ of agricultural products, and exhibiting them in all their progressive stages of manufacture, together with the latest information in regard to cultivation and the working up of the raw material. These two divisions, the State and general, will be confined to the productions and manufactures of our own country; the third, or economic, will be modelled in some measure upon that of the permanent exhibition of Algiers and the colonies in Paris, a very full description of which was given in my report of last year. It will comprise specimens of everything of commercial or agricultural value from all parts of the world, such as vegetable substances and their products, mineral substances and their products, and animals and animal manufactures, including oils, dyes, drugs, gums, cereals, fibres, woods, &c., &c., with references to works in the library containing a full account of their growth, habits, uses, and methods of manufacture. But as this subject will be more fully illustrated and explained hereafter, I shall now proceed to report, first, upon the special questions that have been referred to me as entomologist, and, secondly, upon the history and economy of insects in general.

A majority of the communications received during the year have been from the west, and the insects most generally complained of are the western potato-bug, *doryphora 10-lineata*, and the Kansas or western grasshoppers. The potato-bugs seem to have been particularly destructive in Iowa, and some complaints have also come from Kentucky, Illinois, and other western States. The best and surest remedy recommended is to shake or pick the insects from the plants into a tin pan, or other vessel, where they may be easily scalded or otherwise killed. The damage they have done appears to be greater in Iowa than elsewhere.

The ravages committed by the grasshoppers have been far more extensive and severe. All the far western Territories have suffered much. From Kansas the complaint has been especially bitter. During a period of five months, in 1865, these pests covered the entire territory of Washington, Oregon, California, Utah, and New Mexico. Many communications have been received on the subject, and among them one from a committee of gentlemen in Miami county, Kansas, embodying the following questions, to which the succeeding reply was given:

"*To the Hon. Commissioner of Agriculture:*

"SIR: The grasshoppers, so called, that have overrun Kansas, have already destroyed the young winter wheat, and have honeycombed the fields with their nests and eggs, causing serious apprehension of future famine, should these eggs become living insects. They are probably the red-legged locusts. As almost total ignorance prevails in regard to their habits, we most respectfully ask such information as may be in possession of the department on the following points:

"1. Will the eggs survive our winter? and if so,

"2. At what time do they hatch, and when will they become seriously destructive? and, in this connection,

"3. What crops may we expect to secure before that time arrives?

"4. When are they likely to leave, and what becomes of them? Remarking, incidentally, that while the late corn has been entirely stripped of its blades, the sorghum, though still green, remains untouched, we ask,

"5. Is it likely that the sorghum, or any other crop, will remain exempt from their ravages?

"Considering the great importance of this matter to the agriculturists of Kansas, we propose to procure the publication of your answer."

Some specimens of the insects complained of accompanied this letter, to which the following reply was given:

"The 'locust' sent is almost, if not perfectly, identical with the *Acridium (Caloptenus) femur rubrum*, or red-legged locust of Harris, (p. 175,) and is a western variety, with longer wings, known as *Caloptenus spretus* by some entomologists. According to accounts given by some of our correspondents who have studied the habits of this insect, the eggs are deposited in the earth, and in the spring the greater number of these hatch, not into grubs, as many suppose, but into very minute grasshoppers, perfectly formed, like their parents, except that they have no wings whatever. In this stage they feed upon the herbage, and, being incapable of flight, cannot migrate far from where they were hatched. After some time they shed their skin and acquire rudimentary wings and wing covers, but are still unable to fly; and it is only in the last or perfect stage of their existence that the wings and wing cases are perfectly developed, and the insects are enabled to make long flights, to migrate in search of food, and to propagate their species.

"In answer to your queries—

"1. It is most probable that the eggs will retain their vitality during the winter.

"2. You may expect a majority of the eggs to hatch early in spring, and from the day they hatch till they have migrated and deposited their eggs, they will destroy the crops, especially in the localities where they are undergoing their transformations and acquiring wings.

"3. No crop is safe from their attacks. Even tobacco is devoured by them, particularly when other green crops have been destroyed. It is stated by some that sorgho is an exception, and that it is not touched by them; by others this is contradicted.

"4. They will not leave the neighborhood where hatched until they have acquired wings, when most of them will probably migrate in search of fresh food.

"5. From present knowledge we cannot say certainly whether the sorgho will escape their attacks or not, nor, if it does, can we give the reason why.

"Fall and winter ploughing are recommended for disturbing and destroying the eggs; also, firing the grass when the young locusts are wingless and cannot escape, or rolling the land when they are first hatched, and are not as agile as when more fully grown."

Since the above correspondence transpired letters have been received stating that in many localities of very extensive range "the gronnd is so covered with grasshopper eggs it looks as if bushels of rice had been strewn over it, and every mild day thousands of the young insects may be seen, but so minute at

first as to be scarcely observable. In all probability the country will suffer greatly from their ravages."

In connection with this subject may be mentioned the following facts in regard to the *Cicada septendecim*, or seventeen-year locusts, as furnished by a correspondent in Johnstown, Pennsylvania:

"In a certain district east of the summit of the Alleghany mountains, the seventeen-year locusts appeared in 1834 and in 1851, and consequently may be expected again in 1868. In another district, west of the summit of the Laurel Hill, they were up in 1849, and again this season, 1866. In 1849 they appeared about the middle of May, but this year not until the first of June. Their period of open-air existence is about forty-two days, during which time their eggs are deposited. They inflict great injury on trees by depositing their eggs in the young and growing branches, which they pierce for that purpose. The branches thus injured always die. A very remarkable circumstance connected with their appearance is, that the valley between the summit of the Alleghany mountains and the Laurel Hill is free from their visitation."

A fruit grower in Grayson county, Virginia, says of the common rose bug, (*Macrodactylus subspinosus*:) "This is the third year that they have appeared in such immense numbers. Last year my entire crop of apples was destroyed by them. They cluster upon the young apple and destroy it when about the size of a strawberry. I have grapevines of the Isabella, Concord, and Diana varieties, and not a bunch do these insects leave me. Raspberries are not spared, and roses are totally eaten up by them. They come about the last of May and disappear towards the end of June. Millions of them may be seen on an apple tree, and they are like swarms of bees in the air."

A history of these insects and the remedies will be found in our report for 1863.

A brief synopsis of a portion of the correspondence received during the two or three months when insects are most numerous may be interesting, as showing the localities visited and the damage done or in prospect. To give all, or even to refer to all, would occupy more room than is allowed for this report. And here let us again urge those writing about the depredations of insects to send specimens, safely secured in small boxes, or otherwise; they will come free of postage, and we shall then be able to identify them and give their true names, which no amount of crude descriptions will enable us to do. In consequence of the very limited dissemination of entomological knowledge among the mass of farmers, great confusion exists as to names and characters of common insects; and such a plan as this would not only do much towards remedying it, but also prove highly interesting and beneficial to agricultural communities. The notes referred to are as follows:

Denton county, Maryland.—Wheat attacked by the fly and joint-worm.

Newcastle county, Delaware.—Wheat taken almost wholesale by the fly when the use of phosphates is omitted, even though the ground is otherwise good.

Centre county, Pennsylvania.—The caterpillar (probably *Clisiocampa Americana*—Harris) has been very destructive to fruit trees.

Suffolk county, Massachusetts.—No apples, on account of the canker-worm.

Adams county, Ohio.—The Hessian fly commenced its ravages on wheat May 30.

Wells county, Indiana.—Wheat injured by a small worm.

Lehigh county, Pennsylvania.—Legions of caterpillars (probably *Clisiocampa Americana*) made their appearance, entirely devouring leaves and blossoms on some trees.

Door county, Wisconsin.—No turnip seed; grasshoppers cut off our entire crop, seeds and all, last year.

Perry county, Pennsylvania.—Peach trees on the decline. They grow and begin to bear, then dry away and die. The worms (*Trochilium* or *Ægeria exitosa*) kill many of them, but some die without any apparent cause.

Kent county, Maryland.—Wheat much ravaged by the midge, or Hessian fly.

Van Buren county, Michigan.—Wheat on the openings troubled with the Hessian fly.

Sarpy county, Nebraska.—The tent caterpillar not so numerous as for the last three years. The potato bugs (*Doryphora* 10-*lineata*, or ten-lined spearman) appearing—a soft, red, filthy-looking bug when growing; hard-shelled, striped when grown, a little oval, and about one-third inch in diameter. Remedy: knock them off and scald, burn, or soap them. Worse on white neshannock than others.

Trimble county, Kentucky.—The tobacco-worm is the most formidable enemy of the weed, and this season many planters in this county have administered poison to the fly which lays the eggs. A few drops of ratsbane or other poison in a liquid form are put into the flower of the Jamestown weed, wild morning-glory, &c., into which they are sure to insert their long sucking tubes and die almost instantly. With the death of each fly or miller, three to five hundred eggs are destroyed, each of which would produce a worm.

Hardin county, Kentucky.—Late potatoes injured by drought and the bugs.

Jackson county, Florida.—The caterpillar appeared in the cotton-fields—too late, however, to do much damage this season—doubtless the *Noctua (anomis) xylina* of Say.

Jackson county, Illinois.—To get rid of the aphis or plant louse on cabbage, after the louse makes its appearance pull off a waste leaf and turn it upside down on the cabbage that is lousy. Early next morning the lice will be collected in great numbers on the under side of the leaf. Repeat the operation till all are caught.

Woodford county, Illinois.—Potatoes have been damaged to some extent by a beetle never seen here before the present season; it is about one-third of an inch in length, and has ten pale yellow and black longitudinal lines upon its back—probably *Doryphora* 10-*lineata*.

Huntington county, Indiana.—Wheat damaged by the weevil—probably the wheat midge.

Madison parish, Louisiana.—The cotton army-worm reported to have made its appearance—*Noctua xylina* of Say.

Allegan county, Michigan.—"The plum curculio has been destructive upon peaches. Many orchards are entirely stripped. We have also a blight among the apple trees, which, I think, must be the 'insect pear blight' described by Downing. It seems to be general."

Ingham county, Michigan.—The large, white grub-worm—probably the larvæ of some species of beetle—has done much damage to our pastures and meadows, and corn and potato crops—doubtless larvæ of the May-bug or beetle *Lachnosterna*.

Indiana county, Pennsylvania.—Potatoes injured by bugs—probably *Lytta*.

Hamilton county, Tennessee.—The cut-worms very destructive to late corn—probably caterpillar of an *Agrotis*.

De Witt county, Texas.—"The last few days exhibit the worm, which may or may not prove fatal to a large yield of cotton."—*Noctua xylina* of Say.

Hardin county, Texas.—The cotton army-worm appeared in some places about August 12.

Goliad county, Texas.—"The caterpillar is now damaging the cotton very much, and it is feared that at least nine-tenths of the crop will be destroyed."

Winnebago county, Illinois.—The potato crop has been injured by the bug in some places, while the rot has damaged it generally—probably *Doryphora* 10-*lineata*.

Green county, Alabama.—The planters' prospects are gloomy indeed. The boll-worm *(Heliothis armigera)* and caterpillar *(Anomis xylina)* have nearly ruined the crop.

Washington county, Mississippi.—The cotton crop is damaged by the army worm.

Yalabusha county, Mississippi.—"This season has been the most remarkable one in the memory of our planters. All crops have failed more or less. The boll-worm and cotton caterpillar have done much injury."

Tensas parish, Louisiana.—The second crop of cotton caterpillars *(Anomis xylina)* commenced their ravages about the 5th of September, and by the 15th the entire crop of the county was stripped of its leaves.

Atchison, Kansas.—"On the 11th of September we were visited by an innumerable host of grasshoppers, which are now devouring everything that remains green. Our late corn, our late potatoes, our young wheat crop, and our garden vegetables are being consumed. Last year they destroyed the crops of Colorado, and this spring those of Montana, the grasshoppers in each case having made their appearance the fall previously. In the month of May or first of June these grasshoppers were at Junction, about 300 miles west of Fort Kearney. On the 1st of October they reached Fort Kearney. On the 1st of September they were in Riley county, 100 miles west of Atchison. They move in a direction south of east."

Conejos county, Colorado.—"In June there appeared millions of grasshoppers in this valley, threatening, in some districts, to destroy all vegetation, but before they could spread over the entire country a *green fly* made its appearance, which truly proved our salvation. As I found upon close examination, these flies deposited their eggs in the joint or neck of the grasshoppers, which, after two weeks' time, caused their death. The same examination was made by the military officers at Fort Garland, with like results." A request was made that specimens of these "green flies" should be sent to the department for examination; but as yet none have been received, so that it cannot be positively known whether they are *parasites* which will eventually prove a check to the grasshopper.

Letters from Wisconsin gave accounts of the ravages of cut-worms and grasshoppers in that State.

A New Jersey correspondent refers to the tree caterpillars as entirely destroying orchards in his vicinity, and remarks that, "owing to dense ignorance among the people, no attempt is made to prevent them except when, as larvæ, they are committing their ravages, and even then some of the pious will turn up their eyes and talk about the things as a 'plague sent by Providence.'"

INSECTS AND THEIR USES.

Some people look upon all insects as injurious, while the truth is that many of them are the best friends the farmer has, and instead of preying upon his crops they are busily employed during their brief existence in ridding his fields, orchards, and gardens of other insects which are really destructive. It is, therefore, of the greatest consequence to be able to discriminate between friends and foes—to know which to kill and which to spare. Also, in the economy of nature, insects are of great importance as food for birds, fish, and animals, which in their turn become food for man. The caterpillar is devoured by the carabus or an ichneumon fly; these are eaten by insectivorous birds, which either serve us as food or enliven our gardens and groves with their melodious songs. Without insects these birds could not exist, and, although they are not absolutely necessary to human existence, it must be acknowledged we should miss their songs and their cheering presence.

Fishes also live almost altogether on animal food. The gnat or mosquito is taken from the surface of the water by the minnow, and this in turn is swallowed by some trout or pickerel, which next makes its appearance as a great delicacy upon our table. Several animals eat insects, and, as will subsequently be shown, man himself has been glad to accept them as an article of diet, both in the Old World and the New. Insects are also of great use in the fructification of plants and trees by conveying the pollen from one flower to another, especially where

the plants are too far apart for the pollen to be wafted by the wind. Observe in the spring how flies, bees, and other insects dive into the flower cups, and having feasted on the nectar within, emerge covered with the fecundating dust or pollen, which they deposit on the pistils of other plants, fertilizing and making them fruitful, when, perhaps, if left to the chance of winds they might prove seedless and barren.

Insects are very useful as scavengers in removing decayed vegetable and animal substances which would otherwise taint the air and cause sickness. Linnæus states that three flesh flies and their descendants would eat up a dead horse much sooner than a lion could; and we all know how soon a putrid carcass is removed by maggots, which are the larvæ of large flesh flies. Water larvæ purify the element they live in by devouring the smaller animalculæ and the vegetable matter always abounding in stagnant water, and which would otherwise create a noxious atmosphere. Linnæus says, "This will readily appear if an experiment be made by filling two vessels with putrid water, leaving the larvæ in one and taking them from the other; for that with the larvæ in will be found pure and without smell or bad odor, while the other will remain foul and putrid smelling." See also a well-kept aquarium, in which the exact balance has been kept between vegetable and animal life, and the water will be found perfectly clear and free from minute confervæ.

Some insects are of great utility in the arts, for medicinal purposes, for dyes or coloring matter, and in producing silk. These may be noted as follows:

The honey bee *(Apis mellifica)* yields wax and honey. Many other varieties are known besides the common bee of this country. Kirby and Spence state that in Madagascar the *Apis unicolor* is domesticated and produces a greenish honey. *Apis Indica* is cultivated in India, and *A. adansonii* in Senegal. The Egyptian bee, found also in Syria and Arabia, *(Apis fascicata,)* is one-third smaller than our common hive bee, which it resembles, but has the corselet and shield yellow. This bee was successfully introduced into Germany in 1863, and carried from thence to England in 1866, the present year. Fabricius thinks that other bees in the East and West Indies *(Apis acraensis, laboressa, &c.,)* might be domesticated with greater advantage than even our common honey bee. This, however, is to be doubted, as the insects would probably die from the effects of our cold winters.

The Rev. J. Fletcher, in his "Brazil and the Brazilians," gives a list of fourteen different species or varieties of Brazilian wild bees which produce honey; some of this honey, however, is quite sour, but the majority of it is good and sweet. Most of these bees are very small and stingless. He mentions, also, in the same note two kinds of wasps which produce honey.

A section of a hollow tree containing a swarm of stingless bees *(Trigona)* from South America was placed in a sheltered position in the propagating garden of this department; but the bees exhibited very little energy during the summer, and in autumn gradually died off, leaving the trunk with only a small quantity of coarse, dark wax, and no honey at all in it.

The Italian bee *(Apis ligustica*—Spinola) has, however, been recently introduced, and promises to be a valuable acquisition to this country. The bees are said to be more laborious and less inclined to sting than the common bee, from which they may be distinguished by broad orange rings on the base of the abdomen. The American Bee Journal of this year (1866) states that "those workers are pure whose first three abdominal rings are bright orange or buff, the first being slightly, the second more strongly, and the third broadly, bordered with black." The queen is more fully and more brightly colored than either drones or workers. Her abdominal rings have scarcely a perceptible margin of black; those in which the orange color is greatly wanting are degenerate, having a portion of common or black blood.

Bees are frequently termed by the western Indians the white man's fly, as the

common broad-leafed plantain is called by them the white man's footstep, both making their appearance as civilization encroaches upon the Indian hunting grounds.

A species of ant in South America also produces a kind of honey, or sweet substance so called. The abdomen of the insect is distended like a small pea and in it the honey is secreted. The ant, however, must be crushed so as to rupture the body before the honey can be obtained.

The culture of bees, in some countries, is very extensive and profitable. In the Ukrain, it is stated by an old author, some peasants possess from 400 to 500 beehives; and Niebuhr states that on the Nile, between Cairo and Damietta, he fell in with a convoy of 4,000 hives, which were being transported from a region where the season of flowers was past to one where the season was later. Many other nations transport their bees from place to place to find more abundant food for them. A great amount of honey is made in this country, but large quantities are also imported from the West Indies and other places.

Wax is not gathered from plants by the bee, but is produced by secretion in the form of small scales, which exude from between the rings of the abdomen. This fact was discovered by Hübner, who fed a swarm of bees exclusively on honey and water, and found that they formed a comb consisting of wax. White wax is common wax bleached by exposing it in thin slices to the combined influences of light, air, and moisture, after which it is remelted and run into moulds. Wax is also produced by other insects. The female of the *Coccus cerifera*, or wax insect of China, makes a secretion of that nature for the protection of her young. This wax is not common as a commercial product.

The cochineal insect is well known as producing dye or coloring matter. It s a native of South America, where it lives upon the nopal, a species of prickly pear, but in other countries feeds upon a variety of other plants of the cactus family. The male alone has wings. The female is wingless, and attaches herself to the leaf upon which she feeds. Cochineal, as imported, is in the form of little shrivelled grains, covered with a whitish bloom. These are merely the dried bodies of the female insects, which have been killed by boiling water or by oven or stove heat. Those killed by dry heat, and having the most white powder on them, are said to be of the best quality. It has been calculated that it takes 70,000 of these small insects to make a pound. This useful insect was introduced into Gaudaloupe and St. Domingo in 1809, and in 1826–'27 to Cadiz, in Spain, and to the Canary islands. It is reported to have been introduced into Florida, near Fernandina, some years ago; but in 1855 no traces of the insect could be discovered. Leunis states that, in 1850, 800,000 pounds of rough cochineal were imported from southern Spain to England; and, in 1856, the product of the Canaries is estimated at 1,500,000 pounds, having increased to that figure from 8 pounds in 1831. In 1865, 807,646 pounds were imported into the United States, the value of which was calculated at $343,668. Cochineal has been introduced into Algeria, where it is said to succeed very well. As a dyeing material, this article has lately been somewhat supplanted by the aniline colors, an organic alkaloid obtained from coal-tar. Carmine is prepared from the cochineal.

It was thought at one time that the southern red bug, or cotton stainer, so called from its beautiful red color, was capable of producing a brilliant dyeing material, and experiments were made by an able chemist; but it seems to have proved worthless. Before the true cochineal was introduced into Europe, another insect, the *Coccus ilicis*, known also as the *chermes*, was used for dyes. It was found upon a small species of evergreen oak, common in the south of France, Algeria, and on the shores of the Mediterranean. This insect also produces a blood-red or crimson dye, and it is said that the imperishable red colors of Brussels and other Flemish tapestries are procured from it. The grains or balls do not resemble cochineal, but are more like small galls. The insect forms for it-

self a small cocoon, in which its eggs are deposited, and it is the whole mass of this cocoon which constitutes the *chermes* of commerce.

Another insect, the *Coccus polonicus*, is very abundant in Poland, and is extensively exported from that country into Turkey, where it is used for dyeing red. This insect feeds upon a species of polygonum, a plant of the buckwheat family.

Lac is the product of an insect, the *Coccus lacca*, which feeds upon the Indian fig, *Ficus indica*, and the *Ficus religiosa* or sacred fig. Gum lac is gathered in large quantities from these trees, and from other trees also. The female insect is wingless, and generally attaches herself to the bark of the branches. In making the little puncture to fix herself to the spot a great quantity of vegetable matter exudes from the wound, and eventually surrounds the insect, her eggs and larvæ producing on the branch an irregular broad mass, which, when broken, presents a resinous appearance. This is the gum lac of commerce. Stick lac is the resin as taken from the tree, still incrusting the small twig around which it was formed. Seed lac is the small pieces of the broken resin. White shell lac is made of the broken lac, softened in hot water and pressed into thin flat cakes. If stick lac be broken and examined minutely, in the middle of the resin will be discovered the body of the dead insect, and in the little holes produced by this body a minute drop of red fluid, which, being extracted, constitutes the lac dye. It is brought into market in the form of hard cakes, of a dirty purple color, which are used for scarlet, carmine, and other red dyes. Upwards of 1,500 tons of dye and resin are annually imported into England from the East Indies. In 1865 the amount of lac, seed lac, and stick lac imported into this country was 36,117 pounds, worth $3,554; and of lac dye, &c., about 257,000 pounds, worth $43,041.

Shell lac, dissolved in alcohol, forms an excellent coating for amputated branches and for wounds of fruit trees, making a waterproof artificial skin, under which the wood grows till the wound is healed. Lac is also used to stiffen the bodies of hats before the silk is put on; but its greatest use at one time was for making sealing wax, which is done by mixing it with Venetian turpentine, a little Peruvian balsam, and then coloring it with vermilion.

The Spanish blister fly, *Cantharis vesicatoria*, an insect feeding on the ash, lilac, rose, and poplar, is found in Spain, Italy, France, Russia, and also in the west of Asia. Those from Russia are considered the most valuable, and may readily be distinguished from others by their great size and by their color, which approaches that of copper. These insects make their appearance annually in May or June, and are collected from the trees and killed by plunging them into diluted vinegar, or exposing in sieves to the vapor of boiling vinegar and then drying them. When perfectly dry they are packed in casks or boxes, lined with paper, and kept as much as possible from moisture and exposure to the atmosphere. There are several native species of cantharides in this country, which, according to the United States Dispensatory, have been used as substitutes for the *C. vesicatoria*, and found to be equally efficient. These insects are generally known as the potato insect. They feed in swarms on the foliage of the potato, sometimes destroying whole fields in a few days. These might readily be gathered in scoop nets of muslin, and, if a market could be found, be made profitable, at the same time destroying a public pest. *Lytta vittata*, or striped potato fly; *L. cinerea*, ash colored; *L. marginata*, or margined; and *L. atrata*, or black potato fly, are the most common and most destructive. The Dispensatory also speaks of *Lytta nuttali* as bidding fair, at some future period, to become an object of much importance in the western country, as on the plains of the Missouri it was found by Major Long's party to be so numerous, feeding upon the scanty grass, that they were swept away by bushels in order to clear a place for camping. It is said to surpass the Spanish fly in size and splendor, being quite a large insect, with the head of a deep green color, thorax golden green, and wing cases red or

golden purple. Those in the collection of the museum, however, vary much in color, but are all more or less of a golden green metallic hue on the head and thorax, and a beautiful red or copper tint on the wing covers. Lancaster states that from thirty to forty thousand pounds of blister flies are imported into England every year.

The galls of commerce come to us in the form of small round balls, of a dark color, and varying in size from a pea to a marble. These galls are produced by a small membranous-winged fly, *Cynips quercifolii* of Linn., or *Diplolepis gallæ tinctoriæ* of Geoffrey. This insect or gall-fly pierces the shoot or young bough of a small oak, and deposits an egg in the wound. It is thought that a peculiar fluid is instilled into the puncture which irritates the part; the egg, also, growing within the gall or excrescence, becomes a footless white grub, the true larva of the gall fly. It feeds on the vegetable matter around it, thus forming a cavity or oval cell inside of the excrescence. After some time the larva changes to the pupa, and finally emerges a perfect gall fly from a hole gnawed through its covering by the insect itself. It then punctures a branch or leaf, lays its egg, and dies. Those galls are most valued which are without holes, as then the fly has not escaped. These are called blue, green, or black galls, while those which have been perforated by the insect are less valued, are gathered later, and are called white galls.

Galls are imported principally from Smyrna and Aleppo, by which latter name they are usually known, although they are also imported from many other places. They are used in coloring black, and form one of the principal ingredients in making ink.

For writing-ink the Aleppo galls are well bruised, and macerated with water, gum-arabic, and loaf sugar, with sulphate of iron and green copperas crushed, and all together left for some time before use. In 1850 upwards of 270 tons of oak galls were brought to the British market, aside from those imported from other places. It is probable that many of the galls found growing on our native oaks might be used for the same purposes. Our native gall flies, however, are attacked by numerous parasitical hymenopterous insects, which deposit their eggs in the larva in the gall. These eggs become grubs, devour the rightful possessor of the gall, and then make their exit as winged flies, to lay their eggs in other gall insects. Any amateur naturalist may easily satisfy himself that galls are produced by insects if he will open one of the excrescences growing on our native oaks. A small whitish worm will be found in the centre. This is the larva of the gall fly. If a perfect gall be preserved in a state of proper warmth and moisture, the flies will make their appearance. Galls are frequently found on many other trees, and on shrubs and herbaceous plants. The common blackberry is, in some places, particularly subject to them.

Silk, another important article of commerce, is produced by the caterpillar of a small insignificant looking moth, (*Bombyx mori.*) It is said by some that this insect is a native of China, but Leunis states that it originally came from the province of Serica, in southern Asia, where, in autumn, the female lays from three to five hundred eggs upon the body of the white mulberry tree. It is claimed that the silk culture was known as a branch of industry in China 2,700 years before the Christian era. It then spread to Thibet, and was afterwards made known to the Greeks through their wars with Persia. It is said that these insects were first introduced into Constantinople by two Nestorian monks in 555. A reward having been promised for the worms which produce silk, these monks secreted some of the eggs in a hollow cane; this was at the risk of their lives, the penalty for exporting them from China at that time being death. Henry IV introduced silk culture into France in 1601, and Frederick the Great into Prussia in 1700.

The natural history of the silk-worm is much the same as that of several of our common native moths. The eggs are hatched by heat of the atmosphere, or

sometimes by artificial warmth. The young worms are at first of a dark color; they feed upon fresh leaves of the mulberry, and shed their skins three or four times while growing. When fully grown they spin a loose, flossy web, in the centre of which the cocoon is afterwards made. Two fine threads, issuing from two small openings near the mouth, are glued together by a sticky matter resembling silk itself, which is produced from two smaller glands very near the others. The caterpillar turns over and over in the middle of its web, spinning the thread around itself till the perfect cocoon is formed. Those which gradually contract towards the centre, in the shape of a peanut, are considered the best cocoons for making silk. They vary much in color, according to the variety of the worm, some being perfectly white, others yellow, buff, or of a greenish tinge. These last are from Japan, and were, together with several other varieties, presented to the department by M. Guerin Meneville, of Paris. The worm, after perfecting its cocoon, changes to the chrysalis form within it, and in a few days works its way out in the moth state, after which it pairs, lays its eggs, and dies. The cocoons, thus perforated by the moth, are valueless for the purpose of reeling, and are often stained by a dark fluid discharged by the insect at the time of its escape. They are called "knubs," or "husks," and may be carded and spun like wool. The inner surface of the cocoon consists of a gummy matter, and cannot be reeled or used as silk. To prevent the moth coming out the cocoons are baked in an oven, or scalded in boiling water. Mr. Prevost, of California, states that exposing them three days to the heat of the summer sun in that climate kills them.

The article used by anglers, and known as "silk-worm gut," is the silk bag before being spun. The worm, when ready to make its cocoon, is put in pure vinegar for some hours, after which it is cut open, and the silk bags taken out, stretched, and dried. This is the silk gut of the shops.

As the silk-worms are often hatched before the leaf of the mulberry is out, European authorities advise feeding them on lettuce and dandelion leaves, but say they never make as strong and healthy worms as those fed entirely on the mulberry. The *Morus alba*, *Morus multicaulis*, and *Morus moretti*, (see Mr. Prevost's Silk Grower's Manual, California,) are their best food; but, in the museum of the Department of Agriculture some worms were fed entirely on leaves of the Osage orange, *Maclura aurantiaca*, and were healthy, and made excellent silk, although little attention was paid to them.

The length of one thread, when reeled from the cocoon, is said to vary from 300 to 800 yards. Lancaster places it at 1,526 feet; some authors make it much more. One ounce of eggs is calculated by Clarke to produce 26,650 worms, which will make 106 pounds 9 ounces of cocoons, the silk of which, when reeled off, will weigh 10 pounds 10½ ounces. These calculations, however, will vary according to the variety of the worm cultivated.

The principal disease affecting the silk-worm, and often destroying millions of them, is called the muscadine, and is a fungoid growth or mould (*Botrytis bassiana*) which forms in the interior of the worm, and afterwards appears on the surface, though not observable till after death, and sometimes not even then if the skin of the caterpillar is very dry. A similar disease affects the common house fly, which may often be found dead and fastened to the window glass enveloped in a whitish mould. In the silk-worm the disease is caused by overcrowding, and by filth and insufficient ventilation. Lancaster states that, in France, feeding the caterpillars with sugar prevents the disease; others recommend sulphur and chloride of lime. Burning all the refuse leaves, dead caterpillars and filth, might be of use.

The average imports of silk into England from 1856 to 1858 were, annually, seven millions of pounds. In 1840, 2,205,000 pounds were consumed in Lyons, a silk manufacturing town in France. In 1865, $16,597,980 worth of silk was imported into this country; this amount has, probably, been doubled since. The

culture of silk in this country appears to excite little attention at present, owing to the high price of labor. Mr. Prevost, of California, however, states in his Silk Grower's Manual that the business is making some progress there, the climate being peculiarly favorable to the growth of the silk-worm. He has a growing plantation of 2,500 mulberry trees.

There are several large moths, natives of this country, the caterpillars of which would probably produce silk, namely, *Attacus* (*Telia*) *polyphemus*, *Attacus* (*Collosamia*) *promethea*, and *Attacus* (*Samia*) *Cecropia*. The first named has been experimented with by Mr. Trouvelot, of Medford, Massachusetts, who states that in 1865 he had not less than a million of the caterpillars feeding upon bushes covering five acres of ground, and protected by net-work. Of his success or failure in silk-making we have no account.

Our common basket-worm, *Thyridopteryx ephemeræformis*, which feeds indiscriminately upon all deciduous trees, and in the neighborhood of Washington appears to be particularly partial to the red cedar, might be used for silk, provided the fragments of leaves and sticks interwoven with the outer surface of the cocoon could be readily separated from the fibre. The silk, however, would have to be carded, as it would be impossible to reel it.

In the Department museum is a very large cocoon, or rather a mass of cocoons in one, the work of moths found on the isthmus of Panama, and which might be made useful. This cocoon is about eight inches long, by six and a half in its greatest breadth; it is brownish white in color, somewhat triangular in shape, and consists of a thick, parchment-like covering, inside of which are layers of very fine silk, enclosing a mass of cells or cocoons of some gregarious caterpillar, the dead chrysalides of which are still within.

Kirby and Spence mention "ovate nests of caterpillars on the Psidium eight inches long, of gray silk, which the inhabitants of Chilpancingo and other places in South America manufacture into stockings and handkerchiefs." Humboldt observed great numbers of similar nests of a dense texture resembling Chinese paper, of a snowy whiteness, in the provinces of Mechoacan and the mountains of Santa Rosa, at the height of 10,500 feet above the sea. They were on the arbutus and other trees, and were composed of distinct, separate layers, the interior being the thinnest and very transparent. The silk of these nests, which are the work of the social caterpillar of a *Bombyx*, (*B. Madróna*,) was an object of commerce even in the time of Montezuma, and the ancient Mexicans pasted together the inner layers to form a glossy white pasteboard, which may be written on without preparation. Handkerchiefs are still manufactured from it in the "Intendancy of Oaxaca." W. V. Wells also mentions a somewhat similar insect in his explorations in Honduras. He says: "There is also an indigenous silk growing wild among the trees of Olancho, in Central America, the production of a species of silk-worm, constructing a large bag two feet in depth. Depending from trees in the open savannas, at a distance, the nest resembles a huge matted cobweb. A few pounds sent to England was made into handkerchiefs, not easily detected from the common silk, of equal strength and delicacy." And the writer adds, "that a profitable trade in this might be established, as it can be had in any required quantity, simply for the trouble and expense of gathering."

He also says that there is found in South America a very curious silk-producing spider. Mr. Wilder, of Massachusetts, has published the discovery of a silk-producing spider in South Carolina, which he thinks might prove very valuable, if cultivated. It is hoped that his experiments may lead to some practical results.

All spiders produce a very strong fine silk; but the trouble hitherto has been to prevent them from devouring their fellow-captives when in confinement, especially if kept without food for any length of time.

We have received no reports as yet of the *Attacus cynthia*, or ailanthus silk-worm, being cultivated as a silk-producing insect with success in this country,

although it appears to have been perfectly acclimated, and to have bred on the ailanthus tree in the wild state, from specimens which had escaped from confinement. The other foreign silk-worms (specimens of the moths of which were presented to the Department of Agriculture by M. Guerin Meneville, of Paris, namely, *Bombyx (faidherbia) bauhiniæ*, from Senegal—food plant bauhinia; *Bombyx (antheræa) pernyi*, from China; *Bombyx yama mai*, from Japan—food, oak; and *Bombyx mylitta*, from Bengal;) have not been tried here yet, and it is doubtful whether they would prove any better than our native Polyphemus or Cecropia, if as good.

The great trouble with any silk-producing insect, raised in the open air without protection, is from the attacks of cats and insectivorous birds. Several persons who have tried the *Attacus cynthia*, and who succeeded in hatching the eggs, state that the birds destroyed nearly all the worms before they had attained their full growth. Nets over trees might keep them off, but the cost would very much diminish the profits of wild silk culture.

The manna of druggists is the concrete juice, in flakes, of the *fraxinus ornus*, or flowering ash, and several other trees. Many authorities state that it is produced by the puncture of a cicada or harvest fly, or, as incorrectly termed in this country, the singing locust, which bores into the twigs, starting the sap, which hardens as it flows out, and is then gathered as the manna of commerce. The same effect is produced by artificial incisions made in the bark of the tree.

As food for man, insects are of very little utility; yet they have been eaten, both by the ancients and moderns. Pliny tells us that the cossus, the larva or grub of some large beetle, was fatted with flour and esteemed a great delicacy; and even at the present time the grugru, a large fat worm, feeding on the palm trees in the West Indies, is said to be delicious if properly cooked. Locusts, or large grasshoppers, are still used as an article of food by many of the African nations. One author speaks of wagon-loads of locusts being brought into Fez as a usual article of food. Another states that they are used by the Arabs, when there is a scarcity of food. "As a substitute for corn, the Arabs would grind up locusts in their hand-mills, and make cakes of the dough." Our western Indians also use the locust, or western grasshopper, as an article of food, first singeing off their wings, and then, after roasting them in large quantities, pounding them between two stones, and making a kind of dry cake, which is said to be very nutritious.

M. Guerin Meneville, of Paris, presented to this department specimens of the eggs and insect of *corixa femorata*, a water beetle of Mexico, the eggs of which are said to be gathered from the water plants, and used as an article of food by the dwellers near the lakes where they abound. The natives cultivate, in the lagune of Chalco, a sort of carex, called *touté*, on which the insects deposit their eggs very freely. This carex is made into bundles, which are removed to the lake Texcuco, and floated in the water until covered with eggs; the bundles are then taken out, dried, and beaten over a large cloth. The eggs being thus disengaged, are cleaned, sifted, and pounded into flour. The Chinese, after having unwound the silk from the cocoons of the silk worm, cook and eat the enclosed chrysalides. White ants, or termites, are also eaten by many savage nations. The above examples are merely given to show that, although contrary to our ideas of taste, insect food has been, and is yet, used by many savage or half-civilized members of the human race.

We shall now turn our attention to the insects which are the direct benefactors of the farmer, inasmuch as they destroy others that injure his crops. Though unseen and unnoticed by him, they are ever waging war with caterpillars, cut-worms, plant lice, and many other foes to the horticulturist. Almost every noxious insect has its own peculiar enemy in some other insect, which either feeds upon or makes its live body the receptacle for eggs, and the future nest and larder for its young brood. Among the beetles, (coleoptera,) the cicindela

or tiger beetle stands pre-eminent for its carnivorous or insect-destroying propensities. Any farmer must have observed small, brilliant-colored, nimble beetles on dry sandy roads or paths, continually flying a short distance when approached, and again settling down several yards ahead; these are tiger beetles in the perfect state. The larva forms a round hole in the earth rather larger than a quill, and lies hidden in it until some passing insect falls into the trap, when it is immediately seized by a pair of powerful jaws and its juices sucked out. It may be readily ascertained whether the hole is untenanted or the larva is "at home," by introducing a straw or stalk of grass. If the insect is in, it seizes the intruding straw and assiduously endeavors to push it out, thus causing the stalk to move; when, if drawn quietly out, the larva may be brought up with it. The *Calosoma calidum*, a large carabus of a dark color, with several rows of hollow, burnished, copper spots upon the wing cases, is exceedingly useful in destroying caterpillars, grass worms, and other insects, both in the larva and perfect state. When the grass or army worm was extremely abundant in this neighborhood a few years ago, the larvæ of this beetle, or of *C. scrutator*, were found in large numbers feeding upon them, gorging themselves in such a manner as to be almost unable to get out of the way. If kept without food for some time, they will devour each other; and whenever they find one of their own species so filled with food as to be inactive, they have no hesitation in catching and destroying it. *Calosoma scrutator* is said to be very useful in destroying the caterpillar of the canker worm, (*Anisopteryx vernata,*) so destructive to the orchards in the eastern States. The smaller species of *Carabidæ* live in flowers, and most probably devour insects frequenting such places. The *Cleridæ* feed upon insects found in or upon wood. The *Necrophorus*, and other allied insects, are useful in removing decayed and putrefying animal matter, acting in some degree as the scavengers of the insect tribe. The European *Silpha* is said in Europe to destroy other insects. The *Staphylinidæ* are ever hunting about for prey. They are insects of an elongate form, having very short wing cases, found running on the ground, and when disturbed or alighting, they have the habit of curving up the end of the abdomen. The water beetles and their larvæ feed upon the larvæ of mosquitos, gnats, &c. The *Cantharides* as before stated, are of great value for medicinal purposes—making blisters, &c. All the *Coccinellidæ*, or lady-birds, (excepting *Epilachna borealis*, which is one of our largest species,) are beneficial by destroying plant lice and scale insects. They deposit their eggs in the midst of the aphides, and when hatched, the young larvæ immediately commence feeding voraciously upon them, and continue to destroy them until they change to the pupa state; then they remain motionless fastened to a leaf or branch, until they again change to the perfect insect—in this stage to feed on other insects and propagate their species. *Chilocorus bivulnerus*, a small black lady-bird, with two red spots on its wing covers, is very useful in destroying bark lice, which are so injurious to fruit trees. I have observed them eary in spring attacking the pine tree scale, ripping open the cases and devouring a few of the eggs, leaving the rest to fall to the earth when the trees are agitated by the wind, in this way destroying many of this injurious coccus. *Exochomus guexi*, a small red lady-bird with two black spots, is of similar habits. It is of great utility, by destroying the orange scale insect, which has provel so very destructive to the orange tree in Florida. If any farmer wishes to satisfy himself as to the utility of the lady-bird, he can easily do so. By minutely examining his rose bushes in the summer, when covered with lice, he will find an elongate bluish black insect, somewhat resembling an alligator in shape, with more or less orange or yellow spots on the back and sides. This is the larva of a red or black-spotted lady-bug, and if placed under a tumbler with a fresh twig of the plant covered with plant lice, after a few days it will cease eating, fasten itself to a leaf, shed its skin, and assume the pupa state; and in a few days more change again to the perfect insect.

Almost all the *Orthoptera* (grasshoppers, katydids, &c.,) are injurious, with the exception of the *Mantis carolina*, commonly known in the middle States as the rear-horse. The female of this singular insect, in the autumn, deposits, her eggs clustered together, enclosed in an irregular brownish mass, or case, upon the trunks or branches of trees. When the young insects escape from the eggs in the spring, they are so voracious that the stronger ones frequently eat the weaker. They catch their prey by means of the fore legs, which are armed with spines, closing them together like the blade of a knife, thus impaling the unfortunate insect, which is soon devoured. The insects have been successfully raised as far north as the Hudson river, by bringing the egg cases from the middle States, several cases being found fastened to the trees the next autumn, but after that they disappeared entirely.

Mr. Walsh says of the common thrips: "They are generally, if not universally, insectivorous," and that "those occurring on the ears of wheat, both in the United States and Europe, are preying upon the eggs or larvæ of the wheat midge, *Diplosis (cecidomyia) tritici*, and are consequently not the foes, as has generally been imagined, but the friends of the farmer." They are said, however, by gardeners, to be injurious to plants in greenhouses.

The *Neuroptera*, or insects having four wings with netted veins, are almost all friends to the farmer, both in their larval and perfect states, by destroying other insects which are injurious. We will notice first the dragon fly, commonly known as the mosquito hawk or darning needle. The larva of this insect lives in the water and feeds altogether upon other water insects or land insects which chance to fall into the water it inhabits. The perfect insect is also exceedingly voracious, and may be observed on warm summer days hovering over the water or suddenly darting off in pursuit of any insect it has discovered, which, when caught, is carried to some tall water plant and there leisurely devoured. Among insects they may be compared to the hawks among birds, both in their easy, swift, and graceful flight, and as they live entirely by rapine and murder, carefully avoiding any vegetable diet and feeding only upon the bodies of their fellow insects. The water flies and their larvæ (*Phryganea*) serve as food for innumerable fishes. The larvæ of *Hemerobius* and *Chrysopa* live mostly on the plant lice, which are so very destructive to young shoots and leaves of the hop, grape, rose, &c. The eggs are placed on long pedicels on a leaf among the plant lce, and present the appearance of very minute balls, each at the end of an extremely fine hair, and have frequently been mistaken for microscopic fungi. The larvæ feed upon the plant lice, sucking out their juices, then casting away the empty skin.

The perfect insect of the *Chrysopa*, or lace-wing fly, is of a beautiful light green color with delicate gauze-like wings, and eyes like golden balls. Some of them when crushed in the hand give out a most nauseous odor. The ant-lion is very interesting to observe, as it catches its prey by constructing artificial circular pitfalls in sandy places in the shape of a cone, at the bottom of which the larva lies hidden in the sand, ready to seize with its powerful jaws any insect which unfortunately falls in. When this happens the insect is dragged under the sand to prevent its struggles, and there devoured, after which the ant-lion comes out to cast away the empty skin, (always at some distance from the pitfall,) or to repair any damages which may have been caused by the struggling captive, then again returning to await fresh victims. As a general rule the order of Neuroptera is very beneficial to the farmer, doing very little injury to his crops, as with few exceptions they feed on other insects.

The order *Hymenoptera* comprises four-winged insects which have the wings nerved and membranous, such as bees, wasps, ichneumon flies, &c. With the exception of some wood or foliage eating insects, such as saw flies, the gooseberry worm, pear slug, &c., this order is very beneficial by destroying hosts of insects which otherwise would injure the crops of the farmer. Many of the ichneumon flies deposit their eggs in the larvæ of other insects. A single egg is deposited

in the body of a caterpillar, for example, which hatching into a small, footless, whitish grub, devours the fatty matter in the interior of the worm, carefully avoiding the vital parts, sometimes leaving the caterpillar strength enough to change into a chrysalis, when it finishes by devouring the whole inside, or in other cases eating its way out of the weakened caterpillar before it perishes, either to spin a cocoon or to bury itself in the earth preparatory to changing into a perfect ichneumon fly, which again lays its eggs in other caterpillars. *Cryptus inquisitor*, a small yellow-banded ichneumon fly, destroys the *Thyridopteryx ephemeræformis* or basket-worm, which is so destructive to cedar and shade trees in the middle States. The white pine snout beetle is destroyed by an ichneumon which deposits its egg in the body of the perfect insect. *Calandra (Sitophilus) oryzae*, or rice weevil, is destroyed by *Meroporus graminicola*. In Europe, in a similar manner, *Hippodamia maculata*, a small lady-bird, is attacked by a small ichneumon fly, the larva of which, after feeding upon the interior of the insect, eats its way out, then making a cocoon between the dead body and leaf or branch to which it is attached, it changes first into a pupa, and then comes forth as a small four-winged fly. The cabbage moth, *Cerostoma brassicella*, (Fitch,) is destroyed by an ichneumon which deposits its eggs in the worm. The large, hairy caterpillars of the tiger moth, *Arctia (Pyrrarctia) isabella*, do not escape, although so well defended by a thick coating of bristly hairs; they are also destroyed by an ichneumon fly. *Cœnocilius ribis*, of Fitch, is said to destroy the destructive currant-borer, *Trochilium tipuliformis*.

The larch-cheater, *(Tolype laricis,)* a caterpillar devouring the foliage of the larch, is destroyed by a parasite *(Phrygadeuon planosæ* of Fitch) when in the cocoon, the egg probably being deposited in the caterpillar. *Papilio asterias*, the green catterpillar with black bands and orange spots, so destructive to parsley, celery, parsnips, and other umbelliferous and culinary plants, is destroyed by *Trogus excesorius*, a brownish-colored ichneumon fly, which, after devouring the interior, finally eats a large hole in the outer skin of the chrysalis, and makes its escape. *Sirex (Tremex) columba*, the larva of which bores into the wood of the pear and other trees, is destroyed by *Pimpla atrata* or *lunator*, a very large and singular ichneumon fly having an immensely long ovipositor and borer, which looks like three bristles or hairs some inches in length, issuing from the end of the abdomen. Several of these insects have been taken with their ovipositor so firmly inserted into the wood, when boring in search of their victims, which are found in the larva state, deeply buried in the trunk of the tree, that they have been unable to extricate themselves. The larvæ of small wood-eating insects living between the bark and wood are destroyed by *Ephialtes irritator*, a small ichneumon fly, the larvæ of which, after devouring the destructive wood-worms, form for themselves small, oval, paper-like cocoons, with flattened sides, in the burrows made by the former inhabitants. Another much smaller *Ephialtes* and *Bracon* may also be seen near wood-piles in the spring, evidently on the watch for some opportunity to deposit their eggs in wood-boring larvæ. *Attacus (Samia) cecropia*, one of our largest moths, is destroyed by the *Ophion macrurum*, a large, clay-colored ichneumon fly, the perfect insect of which makes its way, in the spring, out of a hole eaten through the tough, thick cocoon of the Cecropia. It frequently troubles young entomologists, who, instead of hatching out the moth they expected, are astonished to find a large hymenopterus insect in the breeding box or cage. *Ophion bilineatus*, and almost all the larger ichneumons, also destroy noxious insects. Many of the smaller ichneumon flies (*Braconides*) destroy the larvæ of destructive beetles living under the bark of trees, and may be seen any fine spring day hovering around logs in wood-yards. Millions of the aphis, or plant louse, are destroyed by the larvæ of minute four-winged flies. *Aphidius* and *Trioxyx*, the perfect insect of which deposits a single egg in each plant louse, which, hatching into a grub, destroys the insect, then gnaws its way out through the empty skin. Any hop or grape grower can, by

careful examination of the leaves most infected with the lice, satisfy himself in regard to this fact. He will find the empty skins of multitudes of the lice, which are of a dirty brownish color, adhering to the leaf, each with a round hole in the abdomen, through which the parasite has escaped. *Pteromalus*, a very small parasitic four-winged fly, is said in Europe to destroy the *Chlorips*, which is destructive to wheat. *Pachymerus calcitrator* (Europe) is parasitic on *Cecidomyia tritica*, wheat-midge or red weevil, so destructive to wheat in this country, whilst another ichneumon, also European, destroys *Cephus pygmæus*, the larvæ of which lives in the stem of the wheat plant. The larvæ of *Chrysobothris femorata*, a beetle destructive to apple and oak wood, are destroyed by a small *chalcis*. The *Eurytoma hordei*, or joint-worm, although belonging to a family essentially parasitical, (insects preying upon other insects,) is said by many authors to be destructive to wheat, barley, &c., by forming hard knots or galls in the stem of the plants. This is doubted, however, by other entomologists, who state that it is merely parasitic upon another fly which causes the swellings. My own experience is that, although I have raised numbers of the true *Eurytoma hordei*, from diseased stems of wheat grown in Virginia, at the same time, and from the same stems, I merely raised two other specimens of parasitic hymenoptera, (belonging near the *Pteromalus*,) which had evidently devoured the grub of the true *Eurytoma hordei*, and no other insects whatever. A species of *Torymus* is also said to destroy the joint-worm. The much dreaded Hessian fly, so destructive to the wheat plant by injuring the stem, is destroyed by a species of *Platygaster* or *Pteromalus*, a very minute hymenoptera, which destroys it after it has assumed the pupa state, in which they spin little brownish cocoons, and in due time eat their way out as perfect flies. The *Chalcididæ* are minute four-winged flies, frequently of bright or metallic colors, and with elbowed antennæ. Some of the species deposit their eggs in the case or outer covering of the bark-louse, or scale insects of the apple, orange, and other trees. The larva, after feeding upon the eggs and body of the insect, makes its escape through a round hole, gnawed through the outer covering of the scale itself. This was frequently found to be the case in Florida, upon examining the large, round, or oyster-shaped scale; but the oblong, attenuated scale, shaped like a long mussel shell—which was the real cause of the orange blight, and has been imported with foreign orange trees—has never appeared to have any such parasite; and, therefore, multiplied so rapidly as to destroy whole groves. Galls on oaks also frequently produce small parasitical four-winged flies, instead of the true cynips, or proper owner of the gall, the larvæ having fed upon the rightful possessor. Some very minute parasites even pierce the eggs of other insects, and deposit their eggs therein; the larvæ produced from them, after devouring the contents, change into pupæ in the empty shells, and escape as a perfect insect. Small ichneumon flies are even produced from the eggs of a heteropterous insect, or plant louse. The tobacco-worm sphinx (*Macrosila carolina*) is destroyed by a minute ichneumon, which deposits its eggs in the body of the caterpillar; the larvæ live upon the fatter matter, and eventually kill the worm before it changes into the chrysalis; they then eat small holes in its skin, spin themselves up in small, oval, whitish cocoons, which frequently remain adhering to the skin of the sickly, dying caterpillar, until the change to the perfect insect, a four-winged fly. Another small parasite destroys the elm sphinx (*Ceratomia quadricornis*) in a similar manner; but the cocoons are agglutinated together, and look like the very minute cells of a species of bee. The lackey caterpillar, *Clisiocampa americana*, or *decipiens*, which forms cobweb-like nests in the forks of fruit trees, is attacked and likewise destroyed by another minute parasite, *Cleonymus clisiocampæ*. The vaporer moth, *Orgyia leucostigma*, is destroyed by *Trichogramma orgyiæ*, seventeen parasites having been taken from one insect. One *Acronycta* caterpillar killed by these insects has no less than forty-four holes bored into its dried skin by the grubs when making their escape. The young caterpillars of *Anisota*

(*Dryocampa*) *senatoria*, so destructive to oak foliage, is destroyed by a small ichneumon, which deposits but one egg in each worm, the dried skins of which, each perforated with a small hole, may be seen by dozens attached to the leaf of the oak in the spring, or early summer. Various species of butterflies are also attacked by these small ichneumon flies; and to show how destructive they must be, out of about twenty apparently healthy chrysalides of *Agraulis vanillæ*, taken from the rails of a fence in Georgia, only three or four changed into the perfect insect; all the rest, upon examination, having been killed by minute ichneumons. Some of these grubs, when they come from the body of their victims, make cocoons of a loose white web which closely resembles a small piece of loose cotton fibres. Ants kill and devour any injured or crippled insects they can find, and have been observed in the south attacking, and even destroying, the healthy caterpillars of the grass army-worm. *Ammophila gryphus*, a large ichneumon-shaped fly with extremely attenuated pedicel, or foot-stalk, to its body, which swells suddenly at the extremity, is often seen in September busily employed in carrying caterpillars to its nest, to form food for its young when hatched. Almost all the allied species have somewhat similar habits, and destroy multitudes of insects. *Larrada argentata*, a small wasp-like insect, was taken in the act of carrying off a cricket a large as itself, no doubt as food for its young. *Eumenes fraterna*, or the potter wasp, is said to fill her clay cells with canker-worms, (*Anisopteryx vernata*,) frequently collecting eighteen or twenty of these destructive caterpillars as food for her young larvæ. One of the common dirt daubers, which form clay cells under the roofs of barns and in other sheltered places, provides nothing but spiders for its young. After filling the cells with half-killed spiders for its larvæ when hatched, it closes the entrance with mud, thus leaving a supply of fresh food. The *Vespidæ*, or wasps, although they do destroy ripe fruit, at the same time act usefully in killing flies and other insects. The *Cicada*, or locust, is carried off by a large species of wasp, *Stizus speciosus;* and the tarantula of California is said to be destroyed by another wasp-like insect, in a similar manner.

The *Lepidoptera*, or butterflies and moths, are all more or less injurious to plants, shrubs, and trees, but only when in the caterpillar state. As butterflies, they live only by sucking the nectar of flowers and do no injury whatever, but the caterpillars produced from their eggs do much injury to the crops. The silkworms are the only species which are beneficial to mankind in the production of the silk of commerce.

Among the *Heteroptera*, or plant bugs, many may be found which are useful by destroying noxious insects, although the majority live upon the juices of plants which they extract by means of their piercer, thus injuring vegetation very seriously.

Mr. Chapman, of Iowa, writes to the department that he has observed *Arma spinosa*, an insect generally considered injurious to plants, feeding with avidity upon the larvæ of *Doryphora ten-lineata*, or ten-lined spearman, the insect so destructive to the potato in the west. We have ourselves seen *Stiretrus diana*, a dark blue plant bug with orange yellow markings, killing the *Epilachna borealis*, a large reddish yellow and black spotted lady-bird which is so injurious to the squash vine foliage. *Reduvius novenarius* is a large and singular looking plant bug of a grayish color, having a high semicircular ridge on its thorax, armed with perfectly arranged teeth or protuberances, somewhat like the spokes of a wheel, (hence also termed the wheel bug.) It is constantly employed, from the moment it hatches from the egg, in destroying caterpillars and other insects by first piercing them with its proboscis and then sucking out the juices. Their eggs are deposited in a hexagonal cluster on the bark of the tree in the autumn. The young ones when first hatched are of a red color and their food is plant lice and other small insects, and when they can find nothing else they destroy each other. As they grow larger they shed their skin, and their food is then

large caterpillars, or indeed any insect they can overpower. A dozen of these insects, if placed near one of the web nests of the caterpillar so destructive to fruit and shade trees, will destroy almost every caterpillar in it, as each one is able to kill and devour several daily. Care must be taken however when handling old insects, as they are apt to sting, and the poison from their puncture being extremely strong, is much more painful and dangerous than the sting of a large hornet or wasp. *Evagorus rubidus*, a medium sized red and black heteropterous insect, preys also upon other insects, and has been found busily employed feeding upon the orange plant louse in Florida. Several species of *Pentatoma*, *Nabis*, *Pyrates*, &c., feed also upon insects, and no doubt destroy a great many of our insect foes. Some of the water bugs feed upon larvæ of mosquitoes which frequent the same water.

The order *Homoptera*, comprising the cicada, tettigonia, (improperly termed thrips,) plant louse, and scale insects are almost all very injurious to vegetation by living upon the juice of growing plants.

Among the *Diptera*, or two-winged insects, many are very useful in destroying or removing putrid animal and vegetable substances, others pass their larvæ state in the bodies of other insects, and like the ichneumon flies, kill great numbers of them, while some, when in the perfect or fly state, feed entirely upon insects, which they pierce with their proboscis to suck their juices. *Midas filatus*, or the orange banded midas, a large black fly, having a broad orange band across the abdomen, destroys other insects; the larvæ, however, feed upon decayed wood.

The family of *Asiliidæ*, in the fly state, feed upon insects. *Asilus sericeus*, a large brownish species, was captured in the spring while flying, feeding upon a humble-bee much larger than itself, which it had killed and was carrying about with it in its mouth or on the end of its proboscis. The curious appearance it presented while thus engaged first attracted attention and led to its capture; indeed nothing is more common in spring and early summer than to see the female of *Dasypogon*, *Asilus* and *Erax* flying from place to place with some large fly which they have captured in order to suck its juice. Doubtless in this way they destroy many noxious insects. The *tachina* and *sarcophaga*, medium sized flies, which resemble the common house fly in color and general appearance, but are much larger, are as beneficial as the ichneumon flies before mentioned, in destroying caterpillars. The eggs, one to three or more, are deposited upon the first three segments of the body of the caterpillar near the head, and where it is impossible for the persecuted worm to get rid of them by biting or pulling them off with its jaws. These eggs are glued to the caterpillar, so that when dry they cannot be removed without tearing the skin. They may frequently be seen upon the grub of the tobacco moth in the shape of small whitish grains on the first segments. It is useless to try to raise any caterpillar on which these eggs have been deposited, as the larvæ when hatched penetrate into the body of the worm, eventually killing it. When they leave it (through holes bored in its skin,) they go into the ground; the outer skin contracts and hardens into a brown oval case, inside of which the pupa is formed. These flies not only attack the tobacco worm, but almost every other caterpillar; they have been found in great numbers on the grass or army worm. *Tachina vivida*, a very bristly large brownish fly, destroys the caterpillars of *Dryocampa* (*Eacles*) *imperialis*, or imperial moth, which feeds upon oak, pine, plane, and other trees. An *Anthrax* has been bred from the chrysalis of a moth. The *Syrphici*, small, active, wasp-like, two-winged flies, generally of a dark color banded with bright yellow, and which may be seen any summer day hovering like humming birds over flowers, are exceedingly beneficial, as the female deposits her eggs near the much dreaded plant lice, where they soon hatch into footless grubs, which immediately begin to feed upon the lice, destroying multitudes of them. When the larva has completed its growth it fixes itself to a leaf and changes to the pupa

state. The perfect fly, when ready to emerge, forces itself out of the thicker end of the pupa case, which is egg-shaped. The larvæ of a species of *Baccha* are very useful in Florida, as they destroy the orange plant lice. A species of *Toxophora*, belonging to the *Bombyliarii*, was produced from the clay case or round, pot-shaped nest of *Eumenes fraterna*, or potter wasp, found adhering to the branch of a small shrub. It had evidently devoured the rightful possessor.

Many other insects beneficial to the farmer might be mentioned, but as those have been enumerated which are the best known and most useful, and as this article is intended for the instruction of farmers and young entomologists, and not for the scientific naturalist, it will be unnecessary to expatiate more on this subject. Sufficient, however, has been said to prove that the study of the natural habits and instincts of insects is of the greatest consequence to the farmer in order to know which are friends and which are enemies. Without the aid of these small predaceous and parasitic allies, noxious insects would increase to such an extent as to render all labor unavailing, for all noxious insects, with very few exceptions, are destroyed by some other insects, either as food for themselves or their young. Thus it is, while there are multitudes of noxious insects destroying our crops, there are at the same time useful ones appointed by a special providence to diminish their numbers, to check their too rapid increase; and while the farmer sees only the damage done by those that are injurious, he never observes those which, unappreciated and unseen, are silently engaged in the work of their destruction.

TOWNEND GLOVER.

Hon. ISAAC NEWTON, *Commissioner*.

REPORT OF THE CHEMIST.

SIR: I have the honor herewith to submit a report of operations in the chemical laboratory of the department since the date of my appointment as chemist. These labors have been limited to a period of six months, and embrace analyses of various kinds made on the application of parties scattered through a majority of the States of the Union. The materials submitted for analysis may be classified under three heads:

1. Soils and natural manures.
2. Produce of soil and educts therefrom.
3. Mineral and metallurgic analyses.

Besides the foregoing, the laboratory has been engaged with analyses for other departments of the public service.

Soil analyses.—Under the class of soils very many analyses have been made for agriculturists, and chiefly for those interested in the cultivation of the grape. The majority of the samples of soil forwarded for analysis are in quantities too small, and do not appear to have been selected with that care necessary to secure a trustworthy analysis upon which the farmer might safely predict the success of his mode of cultivation. In selecting soils for analysis, five or six spadefuls should be taken from different parts of the field, and, after being spread out in a thin layer for several days to dry, should be put twice, at least, through a fine sieve to insure uniform mixture. If a complete analysis be required, not less than two pounds should be sent; for a partial analysis, three or four ounces will be sufficient. If the soils of different parts of a given field vary much in character,

equal amounts from each of the kinds should be mixed together before being sifted.

Very many of the inquiries made of the department show that some (and not a small portion) of the farming community have no clear idea of the value of an analysis of the soil. For example, a farmer sends for analysis a sample of soil which, he states, poisons his crop, and desires to know what the poison is and how to correct it. He gives no information of the crop poisoned, his rotation, nor the position and physical quality of his ground. An analysis of the soil failed to detect any ingredient noxious to plants generally or in excessive quantity, but showed from the debris of rush and marsh plants that it was cold and waterlogged. Chemistry cannot help ground in such condition; and the farmer would do well to remember that the chemical constitution of the soil is only one of the three principal considerations in cultivation, the others being the wants of the crops proposed to be grown and the nature and composition of the manures designed for such crops.

The physical properties of a soil are, perhaps, of more importance to the consideration of the farmer than the chemical constitution. The latter he can control and ameliorate by manure so as to make it suitable for most crops, of which the abundant use of common farm manure on every land is a patent example; but the physical properties of land oppose at every step the efforts of the agriculturist to grow certain classes of plants on soils not physically favorable to their life.

The physical qualities of a soil are exerted upon the atmosphere above it and upon the subterranean water-currents below it; and in proportion as it draws most largely upon these is a soil, generally speaking, most productive. Thus a soil of good physical texture and porosity may excel in value soils which are richer in chemical constituents. Hence, the analysis of a soil to determine its chemical ingredients is of little value if considered as in itself the means of determining the worth or the wants of the land; and if so considered without due regard to its physical condition, the needs of the crops, and the manure at command, it will inevitably result in disappointment and bring chemical science into unmerited disrepute.

Natural manures.—Of natural manures a few have been examined, consisting of peat and shell marl. Samples of peat and muck have also been forwarded with requests for analyses and directions concerning their use. These have been complied with, but particulars are of no public benefit.

Products of soil.—Under this head are placed plants grown for food or technical uses, such as grapes, sorghum, beet, and other sugar-yielding plants, with examination of their educts, as wines and brandies from native juices fermented.

Grapes and wine.—A sample of grapes from a wild grape of the locality, cultivated by Mr. F. B. Faucher, Albany, New York, was received for examination as to its quality as a wine producer. The grapes were red, medium sized, plump, and thin-skinned. They were placed under the press immediately upon arrival, and upon examination yielded: Amount of juice, 65 per cent.; specific gravity of filtered juice not neutralized, 1.084; dry grape sugar, by Fehling's test, 7.66 per cent.; acid, neutralized, calculated as dry tartaric, 8.05 per cent.; cream of tartar present, 1.146 per cent. The grape is deficient in sugar, which cultivation might increase. The comparison of this grape with other varieties may be obtained by reference to the report of the department for the year 1862, p. 570 *et seq.*

A sample of wine from a native grape forwarded by Mr. Heald, of Pepperell, Massachusetts, yielded the following results: Specific gravity, 1.007; tartaric acid per oz., 0.38 grain; sugar, trace; free acid, 3.3 per cent.; extract, 2.4 per cent.; spirit, 9.6 per cent. This wine contains less than the usual quantity of tartaric acid and an unusual amount of acetic acid, and is much too sour for ordinary use. It was not received in good condition, acetic fermentation having set in by reason of the bad sealing of the bottle. Too little care is bestowed upon the man-

ner of forwarding samples of grape juice and wine to this department for examination. By not carefully excluding the external air, the liquid becomes spoiled while in transitu. Mr. Heald calls the grape of this wine the Fox grape; but this term is hardly specific enough, as in various localities different varieties of vine receive this title. No information of the exact grape yielding the juice sent from Albany, examined as above, could be obtained. The chief value of such analyses reverts to the individual, and is of little public good.

Before agriculture can hope to attain a rational amount of assistance from chemical science, there must exist the closest possible union of the field and the laboratory. It is not sufficient to know merely what amount of mineral elements is contained in a root or a grain crop, and whether the soil contains such total quantities, to answer the question whether that crop can be grown profitably on that soil. As regards the plant, it is necessary to know, in addition, at what period of growth any or all of these elements are taken up from the soil; and on the part of the soil, it is requisite to know whether it can eliminate the quantity needed at the time required. Many soils contain every mineral element which a crop requires, but are so slow in decomposition that the crop fails for want of the supply at the right time. Now, to ascertain these wants, and the time when they are felt, experiments on the growing plants should be made almost weekly; and thus a constant communion of work between the chemist and the agriculturist is called for, in order to work out a complete solution of the questions arising in the history of the growth of any of our food crops. This has already been attempted by Professor Anderson, in connection with the Highland Agricultural Society of Scotland, upon two of the most common crops—turnips and potatoes; and though his experiments are neither wholly exhaustive nor of conclusive value here, yet, as examples of the road which chemistry and agriculture must travel together for mutual benefit, they are invaluable, and stand as models for future work. The opportunities which this department enjoys, in the possession of a garden and farm, which may be placed in connection with the laboratory, particularly favor this line of investigation; and arrangements have been made, in conformity with the foregoing expression of views, to ascertain the ratable growth and mineral appropriation of some of our most common crops, at different and progressive stages of their growth. Analyses of crops made in Europe are uncertain guides on this continent, and serve only for general results. Before we have exact knowledge of the wants of our crops, it will be necessary to make, beforehand, a series of analyses similar to those alluded to above; for, inasmuch as the climate of Europe and mode of cultivation differ from those on this continent, so will the proximate principles, in relative amount, differ even in the same species cultivated in both places. The influences of season and climate in developing one set of principles, and of delaying the appearance of another, have been as yet but little studied in our country. It is proposed, during the coming summer, to make a series of analyses on a few of our growing crops, in order to ascertain and determine some of the physiological conditions in the life of these plants; and as the sugar interest is one of great importance in the United States, preparations have been made, by the selection of pure French seed for planting on the farm of the department, to examine the growth of the sugar beet, in reference to the appearance of the sugar in the juice, so as to be able to determine its ratable increase, and the point of growth at which the amount is highest. It is proposed to apply the same mode of analysis to growing sorghum; and thus, having soil, manure, and cultivation of these two valuable sugar-yielding plants under observation and control, it is confidently hoped that some results valuable to American agriculture will be obtained.

Sugar plants.—The lateness of the season when I entered on duty prevented any experiments on the fresh plants. During the early spring, some experiments upon an improved mode of clarifying sorghum juice and sirups were carried out in the laboratory by Mr. William Clough, of Cincinnati, the able editor of the

Sorgo Journal. The improvement consists in the use of metallic salts, of high specific gravity, which, in their passage through the hot and neutralized liquor, carried downward, by their mechanical effects, all impurities, and in a few minutes produced a clear and fine looking sirup. The insolubility of the preparation used as the clarifier serves as the protection to the sugar liquid, so that no poisonous or unpleasant impregnation can occur. Mr. Clough's experiments were satisfactory and successful.

A portion of the sorghum grown in the garden during the past summer, after having been cut in August, was stacked on the ends, stripped of the outer loose leaves, and left in this condition out of doors in the early winter. In the months of December, 1866, and January following, several of these stalks were examined in the laboratory, with a view to ascertain what change had been effected by the exposure to the air, and the occasional night frosts of the late fall. The general result was that the juice had a higher specific gravity, and a larger percentage of sugar, than were yielded by the living cane. The stems examined on January 23d yielded: Total sugar in cane juice, 20.00; cane sugar, 11.10; glucose, 8.90; specific gravity of juice, 1.069. The density of the juice and the total amount of sugar yielded are much higher than that of the fresh sap; the effect of the stacking in air is to evaporate a portion of the water of the sap, leaving a relatively stronger juice. This juice obtained in January may, with advantage, be compared with the juice obtained from the fresh stalks, immediately after being cut, on September 27, 1866. The determinations were made by Dr. J. R. Hayes, then the assistant in the laboratory, upon new varieties sown in the garden, and marked Nos. III and IV. No. III. Specific gravity of juice, 1.083; uncrystallizable sugar, 4.38 per cent.; cane sugar, 7.86 per cent.; total sugar in juice, 12.24 per cent. No. IV. Specific gravity of juice, 1.075; uncrystallizable sugar, 3.60 per cent.; cane sugar, 5.94 per cent.; total sugar in juice, 9.54 per cent. Contrasting the amount of sugar in the fresh and dry cane, the latter greatly preponderates; and were the question only on the amount of sugar to be obtained, the decision would be in favor of working on the partially dried canes; but on observing the ratio of glucose and cane sugar in the fresh juice and that expressed later, it will be remarked that the relative amount of glucose is much higher, so that the sugar appears to be gradually passing into glucose the longer it remains in the cane, showing that the fermenting causes are as active within the stem of the drying cane as after the juice has been expressed and exposed to the air. Several attempts were made in the laboratory to granulate the sugar of this juice; but whether neutralized and defecated or not, the invariable result was the disappearance of cane sugar, and a uniform sirup of uncrystallizable sugar. Thus far, then, laboratory examinations indicate the necessity of evaporating the juice of the recently cut canes, if it is desired to obtain any crystallizable sugar. The dark coloring matters appear also to adhere more closely to the sugar in the juice of dry canes.

It is obvious to every one connected with agriculture that, since the farming community has in practice determined upon the extended cultivation of sugar-yielding plants, there can be no doubt of the duty resting upon the department, and the advantage to be gained by its efforts, to aid the producers in the advancement of their object by affording whatever assistance lies within the power of science. Considering the wide extent of our country, there never can be in true agriculture any clashing of interests, as to what plant is fittest to be grown for yielding sugar. The variety of the climate and the necessities of the cultivator forbid the country to depend on one plant alone. Where the cane ceases to grow, the sorghum and the beet can enter into the rotation, and even these two cannot be considered competitors. The beet produces chiefly cane sugar, and crystallizable sugar can be readily obtained from it. Its refuse, while of no high value as a food material for cattle, is eminently valuable as a manure. The sorghum, while it contains some cane sugar in its early juice, loses it as it ad-

vances in life, and in all cases, by the usual methods of defecation and clarification, its existing sugar is almost wholly converted into uncrystallizable sugar; so that, while for sirup-making alone the sorghum may be superior, it is inferior to the beet as fresh food or fodder for cattle, or as a plant from which sugar can be readily obtained. Considering the universal consumption of sugar by the population of this country—at a rate approaching twenty-five pounds per year for each individual—the rapid augmentation of our numbers, and our dependence upon foreign countries for the greater portion of the supply of this necessary article of diet, the attention of the agricultural community might profitably be directed toward the culture and growth of those plants which not only yield sugar, but are otherwise so useful for fodder and fresh food, and for manure. The statesman acknowledges the propriety of raising crops for our own consumption when the balance of trade is against us, and every consumer desires the home production, if thereby the article be cheaper. After a few decades have passed, the amount of sugar required to be imported for our own use will be enormous. At present we supply only one-third of the demand, leaving nearly 350,000 tons of sugar to be supplied from foreign sources—an amount which in every future year will need to be increased. Thus the necessity for the more extended cultivation of sugar plants is incontestable.

There are but two of these at present known to the civilized world which can, by processes of manufacture, steadily and profitably yield crystallizable sugar. These are the sugar cane and the beet. There are few countries so favored by their extent as to be able to cultivate both plants. The sorghum and maple, as sources of sugar, may be placed out of view, inasmuch as the supply of sugar from both is limited, and the separation of the sugar is not a remunerative process. In all our northern and northwestern States we have the climate, soil, and other favorable conditions for securing a large yield from the sugar-beet; and to the farmer, whether raised for its sugar, or for its fattening qualities for stock, or for its manure yield, it is one of the most valuable of the crops which are embraced in his rotation. The raising of beets for sugar is not, like that of sorghum, an experiment on which opinion is divided. Half a century of growth in France has made it the sugar plant of that country. It has extended into Germany, Prussia, and Poland, and would long since have been the source of the sugar crop in England did not her colonial policy forbid its manufacture. The processes and machinery are brought to a high perfection, and the manufacture of beet sugar is now carried on with the same exactness and economy as that pursued in a cotton mill or other factory. If we add to this the fact that even a slight chemical experience in the matter justifies the assertion that beets raised under an American summer are relatively more saccharine than those grown in Europe, there is certainly a sufficient stimulus to cultivation, and insured security against experimental loss, to justify the American farmers, north of Mason and Dixon's line, in planting large breadths of land in this beet, and in forming manufactories in the vicinity to work them up.

Seeds of the most approved varieties of French and German beet having been imported by the department, a series of experiments on their growth and relative value will be carried out this summer, the results of which will be communicated in a subsequent report.

Setting aside the value of the sugar beet, there are some results of observations made in the laboratory, which appear to indicate that the common varieties of beet will, under proper cultivation, yield a large share of sugar juice—larger, in fact, than is usually supposed. In this respect, the "long yellow turnip beet" yielded a considerable excess over the "Englefield orange globe" and the "Carter orange globe." Thus, of the two varieties cultivated in the garden, under similar conditions, the quantity of juice yielded and residue left were very different. Sixty-eight ounces of each, crushed and pressed, yielded—

Long yellow turnip, 12 ounces of juice, and 56 ounces of residue.

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Englefield orange globe, $7\frac{1}{2}$ ounces of juice, and $60\frac{1}{2}$ ounces of residue. The juice itself varied in the most marked manner.

	Long yellow turnip beet.	Englefield orange globe beet.
Specific gravity of juice	1.040	1.018
Percentage of water	79.84	94.36
Watery extractive and ash	9.26	2.70
Acid, chiefly oxalic	.94	.76
Cane sugar	7.31	2.05

Although these beets were of large size, and therefore did not yield a percentage of sugar equal to younger roots, yet the quantity obtained from the long yellow turnip was unusually large. While it is not advantageous to have very large roots for sugar extraction, there is also no economy in the use of very small ones, on account of the increased labor in the necessary cleansing processes, though they are relatively richer in sugar. In order to obtain the greatest amount of sugar the root should be pushed on rapidly in growth, and be retained in the ground the shortest time possible. A plentiful supply of water in the early summer favors this very much. If the growth of the beet be delayed till late summer, a portion of the cane sugar is liable to be lost by conversion into glucose and lactic acid within the plant. Strong manures, yielding ammonia, appear to favor this change. As the beet family are potash-loving plants, the manure should be chiefly farm-manure, in moderate quantity, with plenty of wood ashes, as these develop the growth of leaves with rapidity, and increase the quantity of sap in the young plants. The results of Corewinder's experiments on the sugar beet, cultivated near Lille, in France, show that the addition of guano to the plants diminishes the amount of sugar in the juice. It would appear as if the introduction of ammoniacal salts into the body of the root favors rapid oxidation, and thereby destroys the cane sugar. The natural acids of the beet are malic and oxalic, the latter being predominant; and as this acid is the result of partial oxidation (or of deoxidation) within the vegetable, its presence might be made to serve as an index to the conditions of the plant favorable to the preservation of cane sugar, and its quantity might be increased by judicious additions of manures containing potash.

An experiment carried out at the Beet-root Sugar Company's farm at Chatsworth, Illinois, during the past year, obtained an average of crystallizable sugar in the juice equal to $7\frac{1}{2}$ per cent.; this falling to $5\frac{1}{2}$ per cent. upon refining. So rich a product for the first year is very encouraging, as the result was obtained on the ordinary soil, unmanured, but rich in native fertility. The beets were not crushed immediately on being raised, owing to the want of machinery; but it is asserted that a loss of but one per cent. of sugar was the result of four months' delay in expressing the juice. Should this account be verified by further experiment, the value of the beet would rise in comparison with sorghum, since it does not appear possible, from results given in this report, to obtain crystallizable sugar from partially dry canes without considerable loss.

MINERAL AND METALLURGIC ANALYSIS.

Under this class are placed samples of minerals used in the arts and manufactures, and the ores of the common and noble metals, as iron, lead, copper, zinc, tin, manganese, silver, and gold.

Samples of paint-earths, as substitutes for oil-colors and suitable for out-door work, pipe-clays, fuller's earth, pottery clays, and similar minerals have been

forwarded to this office by farmers and others, from whose ground they were taken. These have been uniformly examined and reported upon. Numerous samples of gold and silver ores and other metalliferous minerals have been forwarded for examination and report, as well from agriculturists as from private parties not owning the lands from which they come, all requiring a minute and full chemical assay to determine their exact value. A few of these have been acted upon; but it would be very desirable if this last variety of analysis were omitted in the laboratory, as it requires special arrangements not otherwise necessary in an agricultural laboratory, and also has no claim upon the attention of the department, having no bearing upon agricultural progress. Moreover, it occupies a vast deal of the time which otherwise would be more appropriately devoted to the special art for the advancement of which this department was founded. The propriety of any department of the government authorizing work to be done for the benefit of private enterprise is questionable, and as there are at all times abundant sources of employment for chemical science in connection with agriculture, a few of which are alluded to in this report, the work in the laboratory should be confined within its proper sphere of limitation.

Respectfully,

THOMAS ANTISELL, M. D.

Hon. ISAAC NEWTON, *Commissioner*.

REPORT OF THE STATISTICIAN.

SIR: I have the honor to report upon the facts of agriculture and its productions, its changes and its progress, for the year 1866. It has been a period fraught with interest, full of fears and expectations, and crowned with mingled disappointments and successes. While the war raged, plenty ruled; and the year of the greatest military loss and despondency was that of the largest agricultural abundance and hopefulness. The God of battles lighted with smiles the fields of Ceres as an earnest of the light so soon to be shed on those of Mars.

THE CROPS OF 1866.

During the period since 1863 there has been a gradual and regular decline in the more important cereal products, not in itself sufficiently marked to cause hardship, except to the poor, but made more grievous to the great mass of consumers by reckless speculation facilitated by a plethora of monetary circulation and the ease of conversion of national bonds to the ordinary uses of currency. This country has not been singular, during this period, in a dimininished production of cereals. The year 1863 was also one of plenty in England, France, and Europe generally. The following is the estimated acreage and product of wheat in France for that and the two succeeding years:

	Hectares sown.	Hectolitres obtained.
1863	6,918,768	116,781,794
1864	6,839,073	111,274,018
1865	6,891,440	95,431,038

The hectare is 2.471 of our acres, and the hectolitre 3.8375 bushels, and the yields above equivalent respectively to 19.3, 19, and 15.9 bushels per acre. The year 1866 was also one of moderate production in France.

The English harvests, never adequate to a full supply of bread for the people, were in these years deficient in about the same proportion as in France and the United States. In proportion to acreage, however, the usual average yield is as much greater than that of France as ours is smaller.

During the same period the annual product of wheat in the States not in rebellion was estimated, in round numbers, as follows:

1863	173, 000, 000	bushels.
1864	160, 000, 000	"
1865	148, 000, 000	"
1866	143, 000, 000	"

The wheat crop of the United States in 1849 was 100,485,944 bushels; in 1859, 173,104,924—an increase of 72 per cent. The increase in population, during the same period, was nearly 36 per cent. The opening of new wheat lands in the west, the increasing use of farm machinery, and the enlarged facilities for transportation in every direction, tending to a general diffusion and unstinted use of wheat flour, naturally caused the percentage of wheat production to outrun that of population; and the same causes will continue to operate, to a considerable extent, through the present decade. At that rate of increase, the product in 1869 should be 297,000,000. In 1866 it should have been about 242,000,000. It becomes a question of interest and importance, how much has production fallen short of these figures? Its consideration, in view of the late scarcity and high prices, involves an inquiry into the deficient production of the last three years, 1864 to 1866, inclusive. It has been repeatedly canvassed, and the most extravagant, wild, and unfounded calculations have been made, too often in the interest of mad speculation, and designed to excite the fears of consumers and extort exorbitant prices. Serious as the deficit has been, it has been grossly exaggerated, after the crop has mainly passed out of the hands of producers, and has become so reduced as to be easily controlled. This falsification has been so uniform, near the close of each crop year, and so persistent and bold, that the most erroneous notions have seized the public mind as to the extent of the loss.

Estimating then, as above, the wheat crop of the States reported for four years past at 143,000 bushels, the product of the eleven southern States, now first included in our statistical reports at 17,000,000, and that of the Pacific coast at 15,000,000, (California yielding 11,000,000,) the total product of the United States would be 175,000,000 bushels, instead of 242,000,000, which we should have upon the ratio of increase between 1850 and 1860. This indicates a falling behind anticipated progress to the extent of 67,000,000 bushels, a deficiency sufficiently great to satisfy croakers, who deem erroneous any statement looking to more than half a crop.

The corn crop for the whole country, in 1866, was estimated at 880,000,000 bushels. A portion of it was in bad condition, not to be counted at the full value of good corn. The deficiency was, therefore, practically augmented, tending to high prices, and anticipations of scarcity.

An examination of the following tables will reveal, approximately at least, other peculiarities of the harvest of 1866.

A.—*Showing the amount in bushels, &c., of certain principal crops of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop, for* 1866.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
MAINE.					
Indian corn .... bushels..	1,624,239	33	49,219	$1 35	$2,192,723
Wheat............ " ..	193,150	12.7	15,208	2 86	552,409
Rye.............. " ..	156,649	17	9,215	1 39	217,742
Oats............. " ..	2,653,626	27.7	95,799	69	1,831,002
Barley........... " ..	742,619	24	30,943	1 02	757,471
Buckwheat........ " ..	367,384	31	11,851	90	330,646
Potatoes......... " ..	6,146,725	156	39,402	51	3,134,830
Tobacco .... pounds..	....	......	....	....	....
Hay.............. tons.....	957,772	.8	1,197,215	19 28	18,465,844
Total................	....	......	1,447,470	....	27,482,667
NEW HAMPSHIRE.					
Indian corn .... bushels..	1,321,281	32	41,290	1 37	1,810,155
Wheat............ " ..	305,653	16.2	18,868	2 58	788,585
Rye.............. " ..	161,559	16	10,097	1 39	224,567
Oats............. " ..	1,481,018	29.2	50,720	68	1,007,092
Barley........... " ..	105,038	25	4,202	1 19	124,995
Buckwheat........ " ..	76,455	22	3,475	1 08	82,571
Potatoes......... " ..	3,692,860	132	27,976	49	1,809,501
Tobacco .... pounds..	....	......	....	....	....
Hay.............. tons.....	665,395	.84	792,137	17 88	11,897,263
Total................	....	......	948,765	....	17,744,729
VERMONT.					
Indian corn .... bushels..	1,490,975	33.3	44,774	1 41	2,102,275
Wheat............ " ..	614,692	20.2	30,430	2 67	1,641,228
Rye.............. " ..	154,783	18.5	8,367	1 51	233,722
Oats............. " ..	4,846,015	40.3	120,249	63	3,052,989
Barley........... " ..	104,390	29	3,600	1 23	128,400
Buckwheat........ " ..	225,252	30	7,508	1 00	225,252
Potatoes......... " ..	5,305,045	148	35,845	43	2,281,169
Tobacco .... pounds..	59,000	......	....	....	....
Hay.............. tons.....	862,878	1	862,878	15 61	13,469,525
Total................	....	......	1,113,651	....	23,134,560
MASSACHUSETTS.					
Indian corn .... bushels..	2,363,245	34	69,507	1 34	3,166,748
Wheat............ " ..	160,123	14.9	6,563	2 78	445,142
Rye.............. " ..	401,538	17.2	23,345	1 38	554,122
Oats............. " ..	1,278,465	29.2	43,783	76	971,633
Barley........... " ..	144,598	22	6,573	1 27	183,639
Buckwheat........ " ..	101,946	20.4	4,997	1 02	103,985
Potatoes......... " ..	3,351,030	139	24,108	69	2,312,211
Tobacco .... pounds..	5,171,400	......	....	20	1,034,280
Hay.............. tons.....	742,872	1	742,872	28 39	21,090,136
Total................	....	......	921,748	....	29,861,896

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
RHODE ISLAND.					
Indian corn.......bushels..	408,293	27.3	14,956	$1 42	$579,776
Wheat............ " ..	1,413	15	94	2 80	3,956
Rye.............. " ..	32,658	17.6	1,855	1 44	47,0[illegible]
Oats............. " ..	154,222	35	4,406	73	112,582
Barley........... " ..	35,031	28.3	1,237	1 15	40,250
Buckwheat........ " ..	....	18	....	1 50	....
Potatoes......... " ..	499,440	105	4,757	80	399,552
Tobacco..........pounds..	1,035	....	....	....	....
Hay..............tons.....	53,379	1	53,379	31 66	1,689,979
Total...............	....	....	80,684	....	2,873,123
CONNECTICUT.					
Indian corn.......bushels..	2,220,502	33	67,288	1 26	2,797,832
Wheat............ " ..	71,881	17.3	4,155	2 83	203,423
Rye.............. " ..	776,030	13	59,695	1 50	1,164,045
Oats............. " ..	2,741,448	32	85,670	71	1,946,428
Barley........... " ..	19,200	23.5	817	1 27	24,384
Buckwheat........ " ..	348,632	15	23,242	98	341,660
Potatoes......... " ..	1,480,268	109	13,580	81	1,199,017
Tobacco..........pounds..	7,840,974	1200	6,534	19.5	1,528,990
Hay..............tons.....	536,527	1.4	383,233	25 60	13,735,091
Total...............	....	....	644,214	....	22,930,870
NEW YORK.					
Indian corn.......bushels..	22,809,893	27	844,811	1 16	26,459,475
Wheat............ " ..	12,556,406	15.2	826,079	2 67	33,525,604
Rye.............. " ..	5,309,874	16.3	325,759	1 21	6,424,947
Oats............. " ..	54,029,360	33	1,637,253	61	32,957,903
Barley........... " ..	4,459,288	23.5	189,757	1 06	4,726,845
Buckwheat........ " ..	6,476,597	26.2	247,198	92	5,958,469
Potatoes......... " ..	31,156,676	107	291,184	69	21,498,106
Tobacco..........pounds..	9,824,384	718	13,683	13.5	1,326,291
Hay..............tons.....	4,759,516	1.2	3,966,264	16 18	77,008,969
Total...............	....	....	8,341,988	....	209,886,609
NEW JERSEY.					
Indian corn.......bushels..	9,539,223	43.3	220,305	1 03	9,825,400
Wheat............ " ..	1,278,347	13.5	94,692	2 93	3,745,557
Rye.............. " ..	1,408,497	14	100,607	1 26	1,774,706
Oats............. " ..	6,498,487	34.5	188,362	61	3,964,077
Barley........... " ..	27,167	20	1,358	1 00	27,167
Buckwheat........ " ..	861,376	18	47,854	1 15	990,582
Potatoes......... " ..	4,039,708	77	52,464	86	3,474,149
Tobacco..........pounds..	153,691	....	....	....	....
Hay..............tons.....	369,566	1.26	293,306	25 00	9,239,150
Total...............	....	....	998,948	....	33,040,788

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
PENNSYLVANIA.					
Indian corn ....bushels..	35,831,877	34.4	1,041,624	$0 91	$32,607,008
Wheat .... " ..	10,519,660	11	956,333	2 67	28,087,492
Rye .... " ..	6,569,690	13.6	483,065	1 17	7,686,537
Oats .... " ..	54,954,560	33	1,668,320	50	27,477,280
Barley .... " ..	621,574	22.3	27,873	1 09	677,515
Buckwheat .... " ..	9,718,723	21.4	454,146	96	9,329,979
Potatoes .... " ..	15,636,859	99.3	157,471	76	11,884,013
Tobacco ....pounds..	4,960,886	800	6,201	17	843,350
Hay ....tons	1,970,836	1.2	1,642,363	16 14	31,809,293
Total................	....	....	6,437,396	....	150,402,467
DELAWARE.					
Indian corn ....bushels..	4,281,570	16	267,598	87	3,724,966
Wheat .... " ..	685,720	8	85,715	3 00	2,057,160
Rye .... " ..	41,853	9.5	4,406	1 33	55,664
Oats .... " ..	2,317,857	15	154,523	55	1,274,821
Barley .... " ..	5,973	8	746	1 00	5,973
Buckwheat .... " ..	17,205	27.5	626	1 37	23,570
Potatoes .... " ..	270,220	75	3,603	70	189,154
Tobacco ....pounds..	....	....	....	....	....
Hay ....tons	26,820	1.1	24,382	17 50	469,350
Total................	....	....	541,599	....	7,800,658
MARYLAND.					
Indian corn ....bushels..	15,024,176	30	500,808	93	13,972,483
Wheat .... " ..	4,383,708	9.7	451,929	2 94	12,888,101
Rye .... " ..	476,770	11	43,343	1 16	553,053
Oats .... " ..	7,056,145	26.6	265,269	55	3,880,880
Barley .... " ..	25,262	25	1,010	1 00	25,262
Buckwheat .... " ..	198,498	25	7,940	1 08	214,378
Potatoes .... " ..	1,401,832	70	20,026	80	1,121,465
Tobacco ....pounds..	29,963,672	693	43,237	10.3	3,086,258
Hay ....tons	181,341	1.3	139,493	20 27	3,675,782
Total................	....	....	1,473,053	....	39,352,316
VIRGINIA.					
Indian corn ....bushels..	24,369,908	20	1,218,495	73	17,790,033
Wheat .... " ..	4,331,364	6.7	646,472	2 85	12,344,387
Rye .... " ..	698,453	9	77,606	1 06	740,360
Oats .... " ..	10,245,156	20	512,258	45	4,610,320
Barley .... " ..	....	....	....	....	....
Buckwheat .... " ..	162,686	16.5	9,860	85	138,278
Potatoes .... " ..	1,592,166	83	19,183	66	1,050,830
Tobacco ....pounds..	114,480,516	718	159,444	13.7	15,683,830
Hay ....tons	203,698	1.3	156,691	14 28	2,908,807
Total................	....	....	2,800,009	....	55,266,845

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
NORTH CAROLINA.					
Indian corn .... bushels..	21,656,566	12	1,804,714	$1 12	$24,255,354
Wheat .... " ..	2,846,223	5.8	490,728	2 72	7,741,727
Rye .... " ..	371,327	6.7	55,422	1 70	631,256
Oats .... " ..	2,948,771	14.3	206,208	71	2,092,627
Barley .... " ..	2,928	......	......	......	......
Buckwheat .... " ..	29,098	16	1,819	1 32	38,409
Potatoes .... " ..	830,565	81	10,254	71	588,701
Tobacco .... pounds..	39,423,900	683	57,722	20.5	8,081,399
Hay .... tons	163,229	1.3	125,561	13 00	2,121,977
Total..............	......	......	2,752,428	......	45,551,450
SOUTH CAROLINA.					
Indian corn .... bushels..	6,026,242	5.9	1,021,397	1 58	9,521,462
Wheat .... " ..	642,815	4.7	136,769	3 19	2,050,580
Rye .... " ..	53,454	5	10,691	1 98	105,839
Oats .... " ..	655,881	8.3	79,023	1 11	728,028
Barley .... " ..	......	......	......	......	......
Buckwheat .... " ..	......	......	......	......	......
Potatoes .... " ..	158,714	80	1,984	1 03	163,475
Tobacco .... pounds..	52,206	......	......	......	......
Hay .... tons	70,069	1	70,069	22 00	1,541,518
Total..............	......	......	1,319,933	......	14,110,902
GEORGIA.					
Indian corn .... bushels..	15,695,909	6.2	2,531,598	1 52	23,857,782
Wheat .... " ..	1,272,456	4	318,114	2 72	3,461,080
Rye .... " ..	69,319	4.8	14,441	1 34	92,887
Oats .... " ..	985,454	10.7	92,098	1 00	985,453
Barley .... " ..	11,745	8.2	1,432	1 84	21,611
Buckwheat .... " ..	1,922	......	......	......	......
Potatoes .... " ..	258,221	62	4,165	77	198,830
Tobacco .... pounds..	1,195,113	625	1,912	32	382,436
Hay .... tons	46,448	0.9	51,610	23 62	1,097,125
Total..............	......	......	3,015,370	......	30,097,204
FLORIDA.					
Indian corn .... bushels..	1,984,073	13.2	150,308	1 50	2,976,110
Wheat .... " ..	......	......	......	......	......
Rye .... " ..	12,783	......	......	......	......
Oats .... " ..	18,759	22.5	834	1 25	23,449
Barley .... " ..	......	......	......	......	......
Buckwheat .... " ..	......	......	......	......	......
Potatoes .... " ..	15,388	187	82	85	13,080
Tobacco .... pounds..	......	......	......	......	......
Hay .... tons	9,756	3	3,252	20 62	201,163
Total..............	......	......	154,476	......	3,213,808

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
ALABAMA.					
Indian corn ....bushels..	21,597,083	9	2,399,676	$1 51	$32,611,595
Wheat............ " ..	657,960	5.7	115,432	2 34	1,539,626
Rye............. " ..	43,474	6.5	6,673	2 12	92,165
Oats............. " ..	497,990	11.4	43,683	1 05	522,890
Barley........... " ..	9,383	9	1,042	1 87	17,546
Buckwheat .... " ..	....	....	....	....	....
Potatoes .... " ..	422,815	107	3,951	79	334,024
Tobacco ....pounds..	349,371	322	1,085	31	108,305
Hay.............tons.....	80,854	1	80,854	18 63	1,506,310
Total..............	....	....	2,652,396	....	36,732,461
MISSISSIPPI.					
Indian corn........bushels..	11,913,650	14.5	821,631	1 57	18,704,430
Wheat............ " ..	258,687	5	51,737	2 53	654,478
Rye............. " ..	23,684	7.6	3,116	2 03	48,078
Oats............. " ..	101,768	10.4	9,785	1 09	110,927
Barley........... " ..	1,060	14	76	2 08	2,205
Buckwheat .... " ..	1,700	....	....	....	....
Potatoes .... " ..	385,318	76	5,070	64	246,604
Tobacco ....pounds..	165,507	250	662	30	49,652
Hay.............tons.....	29,611	.87	34,035	27 50	814,302
Total..............	....	....	926,112	....	20,630,676
LOUISIANA.					
Indian corn........bushels..	6,910,035	17	406,473	1 23	8,499,343
Wheat............ " ..	....	6	....	2 50	....
Rye............. " ..	....	5	....	2 50	....
Oats............. " ..	89,377	....	....	....	....
Barley........... " ..	....	....	....	....	....
Buckwheat .... " ..	....	....	....	....	....
Potatoes .... " ..	206,258	85	2,426	1 21	249,572
Tobacco ....pounds..	59,910	400	156	40	23,964
Hay.............tons.....	36,900	....	....	30 00	1,107,000
Total..............	....	....	....	....	....
TEXAS.					
Indian corn........bushels..	20,295,863	26	780,610	94	19,078,111
Wheat............ " ..	1,847,931	12	153,994	1 45	2,679,500
Rye............. " ..	123,046	17	7,238	1 08	132,890
Oats............. " ..	1,084,478	25.5	42,528	86	932,651
Barley........... " ..	60,805	23	2,643	97	58,981
Buckwheat .... " ..	....	....	....	....	....
Potatoes .... " ..	250,822	131	1,915	70	175,575
Tobacco ....pounds..	127,288	829	153	21	26,730
Hay.............tons.....	15,543	1.5	10,366	13 60	211,385
Total..............	....	....	999,447	....	23,295,823

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
ARKANSAS.					
Indian corn.......bushels..	11,585,332	24	482,722	$1 14	$13,207,27[illegible]
Wheat............ " ..	584,137	6.5	89,867	2 06	1,203,32[illegible]
Rye.............. " ..	39,046	10	3,904	1 67	65,207
Oats.............. " ..	308,924	13	23,763	94	290,380
Barley............ " ..	4,737	12.5	379	1 50	7,105
Buckwheat....... " ..	....	16	....	2 00	....
Potatoes.......... " ..	263,346	107	....	81	213,310
Tobacco..........pounds..	1,425,571	650	2,193	32	456,18[illegible]
Hay..............tons.....	7,578	1.3	5,830	26 43	200,287
Total................	....	....	608,658	....	15,643,084
TENNESSEE.					
Indian corn.......bushels..	46,880,933	22	2,130,951	77	36,098,318
Wheat............ " ..	3,985,265	5.3	751,937	2 21	8,807,435
Rye.............. " ..	232,190	8.2	28,315	1 18	273,984
Oats.............. " ..	2,970,836	20	148,542	51	1,515,126
Barley............ " ..	20,115	23.2	867	1 39	27,960
Buckwheat....... " ..	13,322	15	888	1 17	15,587
Potatoes.......... " ..	1,501,146	72	20,849	72	1,080,825
Tobacco..........pounds..	46,054,983	712	64,684	21	9,671,546
Hay..............tons.....	140,580	1.4	100,414	18 63	2,619,000
Total................	....	....	3,247,447	....	60,109,781
KENTUCKY.					
Indian corn.......bushels..	65,564,630	31.8	2,061,781	49	32,126,669
Wheat............ " ..	2,063,256	6.5	317,427	2 30	4,745,489
Rye.............. " ..	419,287	9.3	45,085	1 12	469,601
Oats.............. " ..	5,644,573	21.8	258,925	48	2,709,395
Barley............ " ..	137,516	13.5	10,186	1 37	188,397
Buckwheat....... " ..	14,421	17.5	824	1 17	16,873
Potatoes.......... " ..	1,786,200	88	20,298	67	1,196,754
Tobacco..........pounds..	61,683,856	755	81,700	9.5	5,859,966
Hay..............tons.....	115,844	1.37	84,558	12 80	1,482,803
Total................	....	....	2,880,781	....	48,795,947
MISSOURI.					
Indian corn.......bushels..	46,819,543	30.8	1,520,115	58	27,155,335
Wheat............ " ..	3,544,036	16.5	214,790	2 01	7,123,512
Rye.............. " ..	222,899	19.8	11,258	97	216,212
Oats.............. " ..	3,451,400	30.7	112,423	44	1,518,616
Barley............ " ..	156,297	25.5	6,139	1 03	160,986
Buckwheat....... " ..	68,113	21	3,244	93	63,345
Potatoes.......... " ..	1,059,323	92.3	11,477	79	836,865
Tobacco..........pounds..	12,952,285	877	14,768	11	1,424,751
Hay..............tons.....	654,544	1.9	344,497	9 91	6,486,531
Total................	....	....	2,238,711	....	44,986,153

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Products.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
ILLINOIS.					
Indian corn .... bushels..	155,844,350	31.6	4,931,783	$0 43	$67,013,070
Wheat............ " ..	28,551,421	13	2,196,263	1 93	55,104,243
Rye.............. " ..	666,455	15.6	42,721	79	526,500
Oats............. " ..	30,054,370	34	883,952	33	9,917,942
Barley........... " ..	1,037,753	25	41,510	68	705,672
Buckwheat........ " ..	273,010	16.8	16,250	1 07	292,121
Potatoes......... " ..	5,102,035	86.5	58,983	64	3,265,302
Tobacco .... pounds..	17,546,981	686	25,578	9.3	1,631,470
Hay............... tons.....	2,340,063	1.47	1,591,880	9 27	21,692,384
Total...............	....	....	9,788,920	....	160,148,704
INDIANA.					
Indian corn .... bushels..	127,676,247	36.5	3,497,980	44	56,177,548
Wheat............ " ..	9,114,562	5.9	1,544,841	2 41	21,966,094
Rye.............. " ..	345,144	12.2	28,290	1 03	355,498
Oats............. " ..	10,158,562	29.3	346,709	35	3,555,497
Barley........... " ..	339,474	19	17,867	1 07	363,237
Buckwheat........ " ..	443,094	19	23,321	1 02	451,956
Potatoes......... " ..	3,774,226	79.3	47,594	57	2,151,309
Tobacco .... pounds..	8,205,973	837	9,804	8.4	689,302
Hay............... tons.....	1,088,932	1.23	885,310	9 44	10,279,518
Total...............	....	....	6,401,716	....	95,989,959
OHIO.					
Indian corn .... bushels..	99,766,822	38	2,625,443	54	53,874,084
Wheat............ " ..	10,208,854	4.5	2,430,680	2 52	25,726,312
Rye.............. " ..	591,121	10.8	54,733	1 09	644,322
Oats............. " ..	22,187,420	32.2	689,050	40	8,874,968
Barley........... " ..	1,294,139	19.5	66,366	1 14	1,475,318
Buckwheat........ " ..	1,705,785	18.5	92,205	1 10	1,876,363
Potatoes......... " ..	4,516,640	78	57,905	77	3,477,813
Tobacco .... pounds..	25,593,815	860	29,760	6.7	1,714,785
Hay............... tons.....	1,963,799	1.3	1,510,615	11 00	21,601,789
Total...............	....	....	7,556,757	....	119,265,754
MICHIGAN.					
Indian corn .... bushels..	16,118,680	32	503,709	82	13,217,318
Wheat............ " ..	14,740,630	13.8	1,068,162	2 55	37,588,630
Rye.............. " ..	413,150	15.5	26,655	1 06	437,939
Oats............. " ..	8,293,877	34.7	236,135	47	3,898,122
Barley........... " ..	418,971	25	16,759	1 02	427,350
Buckwheat........ " ..	1,306,819	20	65,341	98	1,280,683
Potatoes......... " ..	5,037,298	110	45,793	56	2,820,877
Tobacco .... pounds..	278,786	1200	232	15	41,818
Hay............... tons.....	1,218,959	1.3	937,661	13 75	16,760,686
Total...............	....	....	2,900,447	....	76,473,423

A.—*Showing the amount of certain principal crops, &c.*—Continued.

Productc.	Amount of crop of 1866.	Average yield per acre.	Number of acres in each crop.	Value per bushel or pound.	Total valuation.
WISCONSIN.					
Indian corn ....bushels..	9,414,583	28.3	332,671	$0 82	$7,719,958
Wheat............ " ..	20,307,920	14.5	1,400,546	1 67	33,914,226
Rye .... " ..	926,492	16.6	55,813	88	815,313
Oats............ " ..	17,174,086	33.3	515,738	54	9,274,006
Barley............ " ..	860,521	25.2	34,148	90	774,469
Buckwheat......... " ..	69,227	16	4,327	86	59,535
Potatoes .... " ..	3,940,273	91	43,300	64	2,521,775
Tobacco ....pounds..	143,344	900	160	20	28,669
Hay..............tons.....	1,151,477	1.3	885,752	12 25	14,105,593
Total...............	....	....	3,272,455	....	69,213,544
IOWA.					
Indian corn ....bushels..	52,288,184	31.5	1,659,942	44	23,006,801
Wheat............ " ..	15,753,323	16	984,583	1 42	22,369,718
Rye .... " ..	116,946	19.3	6,060	69	80,693
Oats............ " ..	12,607,749	37.8	333,538	39	4,917,022
Barley............ " ..	622,784	25.4	24,520	67	417,265
Buckwheat......... " ..	283,714	16	17,732	1 01	286,551
Potatoes .... " ..	2,755,726	72	38,275	89	2,452,596
Tobacco ....pounds..	390,424	988	395	20	78,085
Hay..............tons.....	1,161,039	1.9	611,073	6 20	7,198,442
Total...............	....	....	3,676,118	....	60,807,173
KANSAS.					
Indian corn ....bushels..	6,527,358	34.2	190,858	63	4,112,235
Wheat............ " ..	260,465	21.4	12,171	1 91	497,488
Rye .... " ..	4,548	26.4	172	96	4,366
Oats............ " ..	200,316	39	5,136	47	94,148
Barley............ " ..	7,255	29	250	94	6,820
Buckwheat......... " ..	20,402	28	728	1 54	31,420
Potatoes .... " ..	243,514	81	3,006	1 59	387,187
Tobacco ....pounds..	22,263	550	41	29	6,456
Hay..............tons.....	123,082	2	61,541	7 18	883,729
Total...............	....	....	273,903	....	6,023,849
NEBRASKA.					
Indian corn ....bushels..	2,095,030	29.3	71,503	68	1,424,620
Wheat............ " ..	257,839	26	9,917	1 23	317,142
Rye .... " ..	2,225	26	86	92	2,047
Oats............ " ..	450,138	47.2	9,537	46	207,063
Barley............ " ..	8,184	35.3	232	84	6,875
Buckwheat......... " ..	6,453	26	248	1 85	11,908
Potatoes .... " ..	120,319	49	2,455	1 75	210,558
Tobacco ....pounds..	1,550	430	3	24	372
Hay..............tons.....	29,720	1.5	19,813	6 43	191,100
Total...............	....	....	113,794	....	2,371,685

B.—*A general summary showing the estimated number of bushels, number of acres, and aggregate value of the principal crops of the farm in* 1866.

Products.	No. of bushels.	No. of acres.	Value.
Indian corn	867,946,295	34,306,538	$591,666,295
Wheat	151,999,906	15,424,496	333,773,646
Rye	20,864,944	1,548,033	24,661,290
Oats	268,141,077	8,864,219	135,255,326
Barley	11,283,807	492,532	11,383,698
Buckwheat	22,791,839	1,045,624	22,164,121
Potatoes	107,200,976	1,069,381	72,939,029
Total	1,450,228,844	62,750,823	1,191,843,405
Tobacco ... pounds	388,128,684	520,107	53,778,888
Hay ... tons	21,778,627	17,668,904	317,561,837

C.—*Showing the average cash value of farm products per acre for the year* 1866.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buck-wheat.	Potatoes.	Tobacco.	Hay.
Maine	$44 55	$36 32	$23 63	$19 11	$24 48	$27 90	$79 56	....	$15 42
New Hampshire	43 84	41 79	22 24	19 85	29 75	23 76	64 68	....	15 01
Vermont	46 95	53 93	27 93	25 38	35 67	30 00	63 64	....	15 61
Massachusetts	45 56	41 42	23 73	22 19	27 94	20 80	95 91	....	28 39
Rhode Island	38 76	42 00	25 34	25 55	32 54	17 00	84 00	....	31 66
Connecticut	41 58	48 95	19 50	22 72	29 84	14 70	88 29	$234 00	35 84
New York	31 32	40 58	19 72	20 13	24 91	24 10	73 83	96 93	19 41
New Jersey	44 59	39 55	17 64	21 04	20 00	20 70	66 22	....	31 50
Pennsylvania	31 30	29 37	15 91	16 50	24 30	20 54	75 46	136 00	19 36
Delaware	13 92	24 00	12 63	8 25	8 00	37 67	52 50	....	19 25
Maryland	27 90	28 51	12 76	14 63	25 00	27 00	56 00	71 37	26 35
Virginia	14 60	19 09	9 54	9 00	......	14 02	54 78	98 36	18 56
North Carolina	13 44	15 77	11 39	10 15	......	21 12	57 51	140 00	16 90
South Carolina	9 32	14 99	9 90	9 21	......	......	82 40	....	22 00
Georgia	9 42	10 88	6 43	10 70	15 08	......	47 74	200 00	21 25
Florida	19 80	......	......	28 12	......	......	158 95	....	61 86
Alabama	13 59	13 33	13 78	11 97	16 83	......	84 53	99 82	18 63
Mississippi	22 76	12 65	15 42	11 33	29 12	......	48 64	75 00	23 92
Louisiana	20 91	15 00	12 50	......	......	......	102 85	160 00	......
Texas	24 44	17 40	18 36	21 93	22 31	......	91 70	174 09	20 40
Arkansas	27 36	13 39	16 70	12 22	18 75	30 00	86 67	208 00	34 35
Tennessee	16 94	11 71	9 67	10 20	32 24	17 55	51 84	149 52	26 08
Kentucky	15 58	14 95	10 41	10 46	18 49	20 47	58 96	71 72	17 53
Missouri	17 86	33 16	19 20	13 50	26 26	19 53	72 91	96 47	18 82
Illinois	13 58	25 09	12 32	11 22	17 00	17 97	55 36	63 79	13 62
Indiana	16 06	14 21	12 56	10 25	20 33	19 38	45 20	70 30	11 61
Ohio	20 52	11 34	11 77	12 88	22 23	20 35	60 06	57 62	14 30
Michigan	26 24	35 19	16 43	16 30	25 50	19 60	61 60	180 00	17 87
Wisconsin	23 20	24 21	14 60	17 98	22 68	13 76	58 24	180 00	15 92
Iowa	13 86	22 72	13 31	14 74	17 01	16 16	64 08	197 60	11 78
Kansas	21 54	40 87	25 34	18 33	27 26	43 12	128 79	159 50	14 36
Nebraska	19 92	31 98	23 92	21 71	29 65	48 10	85 75	103 20	9 64

D.—*Showing the average yield of farm products per acre for the year* 1866.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buck-wheat.	Potatoes.	Tobacco.	Hay.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Pounds.*	*Tons.*
Maine	33	12.7	17	27.7	24	31	156	....	.8
New Hampshire	32	16.2	16	29.2	25	22	132	....	.84
Vermont	33.3	20.2	18.5	40.3	29	30	148	....	1
Massachusetts	34	14.9	17.2	29.2	22	20.4	139	....	1
Rhode Island	27.3	15	17.6	35	28.3	18	105	....	1
Connecticut	33	17.3	13	32	23.5	15	109	1,200	1.4
New York	27	15.2	16.3	33	23.5	26.2	107	718	1.2
New Jersey	43.3	13.5	14	34.5	20	18	77	....	1.26
Pennsylvania	34.4	11	13.6	33	22.3	21.4	90.3	800	1.2
Delaware	16	8	9.5	15	8	27.5	75	....	1.1
Maryland	30	9.7	11	26.6	25	25	70	693	1.3
Virginia	20	6.7	9	20	......	16.5	83	718	1.3
North Carolina	12	5.8	6.7	14.3	......	16	81	683	1.3
South Carolina	5.9	4.7	5	8.3	......	......	80	....	1
Georgia	6.2	4	4.8	10.7	8.2	......	62	625	.9
Florida	13.2	......	......	22.5	......	......	187	....	.3
Alabama	9	5.7	6.5	11.4	9	......	107	322	1
Mississippi	14.5	5	7.6	10.4	14	......	76	250	.87
Louisiana	17	6	5	......	......	......	85	400	......
Texas	26	12	17	25.5	23	......	131	829	1.5
Arkansas	24	6.5	10	13	12.5	15	107	650	1.3
Tennessee	22	5.3	8.2	20	23.2	15	72	712	1.4
Kentucky	31.8	6.5	9.3	21.8	13.5	17.5	88	755	1.37
Missouri	30.8	16.5	19.8	30.7	25.5	21	92.3	877	1.9
Illinois	31.6	13	15.6	34	25	16.8	86.5	686	1.47
Indiana	36.5	5.9	12.2	29.3	19	19	79.3	837	1.23
Ohio	38	4.5	10.8	32.2	19.5	18.5	78	860	1.3
Michigan	32	13.8	15.5	34.7	25	20	110	1,200	1.3
Wisconsin	28.3	14.5	16.6	33.3	25.2	16	91	900	1.3
Iowa	31.5	16	19.3	37.8	25.4	16	72	988	1.9
Kansas	34.2	21.4	26.4	39	29	28	81	560	2
Nebraska	29.3	26	26	47.2	35.3	26	49	430	1.5
Grand average	25	10	13	30	22	21	100	746	1.22

The yield per acre of wheat in 1856 exhibits a remarkable range. While the northwestern States generally show an average about equal to the average for four years previous, and in some of them a somewhat superior yield, Ohio falls to 4.5 bushels in place of 12.19 for the previous four years; Indiana, 5.9 instead of 13.1; Kentucky, 6.5 instead of 8.75. Delaware and Maryland show a decrease; the southern States uniformly have low averages, and 1866 was no exception.

The figures for corn show how sure a crop is our native maize in the most unpropitious seasons. South Carolina, Georgia, and Alabama come nearer to a failure in corn than is usual in the worst of seasons.

Oats and barley make a favorable showing, and potatoes bear heavy averages in the eastern States.

THE COTTON CROP.

The hopes of planters were centred upon the cotton crop of 1866 as never before in the history of that valuable fibre. Manufacturers, in this country and in Europe, were scarcely less interested in the success of this effort to renew an important industry and commence the retrieval of fallen fortunes. The people of the whole country were moved to sympathy with the undertaking by the desire to see the Gulf region once more prosperous, as well as by the wish to secure again its contribution to the general wealth of the country.

The crop of 1865 had been planted amid the waning fortunes of the rebellion, when life itself depended on an effort to produce a supply of meat and bread, and cotton was a useless product that could neither be eaten at home nor sent abroad in exchange for needed comforts, and when despondency weighed so heavily as almost to extinguish the desire for life itself. Under such circumstances little could be expected of the crop.

In 1866 a more hopeful spirit existed, and a determination was felt to accomplish all that could be done with the means at hand. It was seen that serious drawbacks to success were inevitable. There was little money to purchase supplies for a year's work; farms had been neglected and seeded to noxious weeds during the years of war and waste; horses and mules were scarce, and implements of husbandry worn out or broken; and the negro, hitherto the artificer of the planter's fortunes, was free, and in the enjoyment of a new-found liberty could scarcely be expected at once to see the necessity of systematic labor in the cotton field. These difficulties were all real, yet the planter was frequently astonished at the alacrity and steadiness of his former chattel in his new relations, while sometimes disappointed in the very hour of his greatest necessities, and compelled to leave his cotton fields to the usurpation of grass and weeds. Yet in the loss of his slave he became himself free, and many a cotton bale was the result of white labor, which will prove a prolific source of cotton and independence in the future.

A sufficient breadth was put in cotton to produce 2,500,000 bales in a good season, but another trial of patience was had in the lateness of the spring, the heavy rains of early summer, the destructive floods, and at last a serious visitation of the army worm. Everywhere depression was felt, and no estimates exceeded a million and a quarter of bales, while few exceeded a million. A careful observation of each county in detail, aided by all outside reports and estimates attainable, with a final analysis of all the causes of success or failure, led to the Department estimate, early in October, of 1,835,000 bales. After the heavy losses by flood and army worm in Louisiana, and the reported insect depredations in Mississippi and elsewhere, that estimate was modified to 1,750,000 bales. The result proved the former figure to be a remarkable approximation to the actual return—an almost literal record of the year's production—though the statement was decried at the time as half a million bales too large, and no other estimate approached it by four hundred thousand bales. Obtained by elaborate calculation of current facts, it may be taken as evidence of the reliability attainable under our present statistical system.

AGRICULTURAL STATISTICS OF GREAT BRITAIN.

For the purpose of comparison—although the dissimilarity in principal products and in other circumstances renders a parallel impossible—the following brief synopsis of Tables Nos. 4 and 5 of the British Board of Trade is given:

E.—*Showing the acreage of farm crops and the proportionate number of farm stock in Great Britain.*

	England.	Wales.	Scotland.	Total.
Population	18,954,444	1,111,780	3,062,294	23,128,518
Area, acres	32,590,397	4,734,486	19,639,377	56,964,260
Acreage in all crops—bare, fallow, and grass	22,261,833	2,284,674	4,158,360	28,704,867
Acreage grain crops	7,400,170	521,074	1,366,540	9,287,784
Acreage green crops	2,750,008	139,265	663,257	3,562,530
Acreage clover and grass in rotation	2,296,087	256,722	1,141,415	3,694,224
Acreage pasture and grass not in rotation	8,998,027	1,257,721	893,066	11,148,814
Percentage of grain crops to total acreage of all crops	33.2	22.8	32.9	32.4
Total number cattle	3,420,044	546,966	968,637	4,935,647
Proportionate number cattle to every 100 acres in crops	15.4	24.0	23.3	17.2
Total number sheep, March, 1866	15,124,541	1,668,663	5,255,077	22,048,281
Proportionate number sheep to every 100 acres in all crops	68.0	73.0	126.4	76.8
Wheat	3,161,431	113,862	110,101	3,385,394
Barley, or bere	1,877,387	146,323	213,619	2,237,329
Oats	1,503,990	251,893	1,004,040	2,759,923
Rye	50,570	2,452	7,055	60,077
Beans	492,586	3,534	28,537	524,657
Peas	314,206	3,010	3,188	320,404
Total under corn crops	7,400,170	521,074	1,366,540	9,287,784
Potatoes	311,151	44,266	143,426	498,843
Turnips and swedes	1,600,706	62,442	478,990	2,142,138
Mangold	254,081	3,864	852	258,797
Carrots	15,598	295	916	16,809
Cabbage, kohl rabi, and rape	159,539	1,329	5,075	165,943
Vetches, lucern, and other crops, (except clover or grass)	408,933	27,069	33,998	470,000
Total under green crops	2,750,008	139,265	663,257	3,552,530
Hops	56,562	14	2	56,578
Bare, fallow, or under-cropped arable land	760,979	109,878	94,080	964,937
Clover and other grasses in rotation	2,296,087	256,722	1,141,415	3,694,224
Permanent pasture meadow or grass	8,998,027	1,257,721	893,066	11,148,814
Total acreage	22,261,833	2,284,674	4,158,360	28,704,867

The total acreage in "corn" crops, or cereals, in the preceding table, may be compared with our estimates for the same crops. Exchanging potatoes, the acreage for which is calculated with our cereals, for peas, beans, and rice, which should be included, the account would stand thus:

Acreage of cereals in England	7,400,170	acres.
Acreage of cereals in Wales	521,074	"
Acreage of cereals in Scotland	1,366,540	"
Total	9,287,784	"
Acreage of cereals in the United States	62,000,000	"

The comparison of aggregate products would not show so great a disparity as might be inferred from the difference in area cultivated. The noticeable feature in this table is the extensive acreage of green crops, 3,552,530 acres. This includes scarcely more than ten per cent. of potatoes, the largest item being turnips and "Swedes," of which there are 2,142,138 acres. Mangolds come next on the list—258,797 acres—followed by cabbage, kohl-rabi, rape carrots, vetches, and other crops. Except potatoes, of which we have a million of acres, we have little to show as "green crops," with the exception of patches in farmers' gardens or market gardens near cities. The moist climate of Great Britain is better adapted to the growth of this class of products, but the root crops, cabbage, &c., have been produced abundantly and cheaply, and fed profitably to stock, and might be made the source of wealth to our agriculture as it is now the sheet-anchor of British farming. Our only requisites for success in this branch of farming are, a better knowledge of the culture and uses of "green crops," and labor-saving implements for their easy cultivation on an extended scale.

FARM PRODUCTS AND DOMESTIC ANIMALS IN EUROPE.

F.—*Prepared by Dr. Von Herman, of the Bavarian Bureau of Statistics, estimating farm products and domestic animals of the countries named.*

Countries.	Bushels for 1,000 inhabitants, deducting seed.							Bushels of oats for 1,000 horses, deducting seed.	Domestic animals for 1,000 inhabitants.			
	Wheat spelt.	Rye.	Mixed grain.	Maize.	Equival't of all in rye.	Barley.	Potatoes.		Horses.	Cows.	Sheep.	Hogs.
Austria	1,866	2,372	552	1,644	7,332	1,815	4,398	39,766	642	1,152	3,006	1,500
Prussia	1,176	4,818	.....	....	6,582	1,140	10,998	60,522	576	1,098	6,114	968
Saxony	2,148	4,088	.....	....	7,410	1,890	13,824	116,748	276	1,176	1,368	696
Wurtemberg	3,816	1,002	324	....	7,128	3,036	10,932	83,694	336	1,626	2,382	756
France	6,084	1,566	528	606	11,892	1,122	3,498	50,472	480	772	5,580	882
Belgium	3,372	2,892	462	....	8,536	834	13,920	63,138	366	876	774	606
Holland	1,050	2,246	.....	....	3,624	954	11,142	35,304	444	1,704	1,566	492
Ireland	828	24	.....	....	3,734	774	11,514	79,026	640	1,782	3,600	1,200
Bavaria	2,778	4,128	.....	....	8,298	2,958	10,936	51,348	486	1,956	2,634	1,188

FARM STOCK IN 1866.

The estimates of the number and prices of farm animals at the close of 1866 indicate a determination on the part of the stock-growers of the country to restore the relative proportion of farm stock to population existing in 1860.

In comparison with 1860, the States represented in the following tables exhibit a decrease of six per cent. in horses, while showing a slight increase during the year. The South has suffered the heaviest loss; New England has been slower in recuperation than the West. Vermont in 1860 numbered 69,071; now the estimate is only 49,222. The serviceable horses of that State were very popular during the war, and the stock was greatly reduced, but is now slowly augmenting, the improvement being estimated at three per cent. during 1866. Massachusetts, with a much smaller supply in proportion to population and an absolute necessity for their use, has about as many as in 1860. The estimate for New York is 437,372; in 1860, 503,725. For Pennsylvania, 404,555; in 1860, 437,654. For Ohio, 546,524; in 1860, 625,346. Some of the western States have increased their stock, particularly those west of the Mississippi.

Prices of horses have retrograded during the year less than other stock. The average as estimated one year ago was $83 84; now it is made $79 46, the difference being due mainly to the fact that the southern States are included in the computation. The estimated average for Texas is but $33 72. In some of the northern States the average is placed higher than last year.

The proportion of mules, in comparison with 1860, seems to be fully thirty per cent. less. The reduction in the southern States has been remarkably heavy. Kentucky is placed at 59,752, in place of 117,634 in 1860. Illinois, Ohio, and some other States have increased their number of mules. The average price has dropped from $100 to $92.

Cows number as many as in 1860, yet show a relative decrease in proportion to population. They appear to be increasing more rapidly than other horned stock or horses or mules. The associated dairy system, in its progress westward, has excited attention to the improvement of dairy stock and increased rapidly the number of cows. The estimate for New York is 1,324,263; the census statement in 1860, 1,123,634. The estimate and census figures for Pennsylvania are almost identical. Ohio is placed at 683,987; in 1860, 676,585. The average of prices is reduced from $47 25 one year ago to $39 77, the difference being caused mainly by low prices in the south.

The number of sheep, including those of the south and of the Pacific coast, are made by these estimates fully forty millions, which supposes an increase of nearly seventeen millions since 1860. Most of those of the south, and many in California, produce small fleeces, reducing the average for the entire country to a little less than three pounds. It is probable that the clip of wool of the present year will make an aggregate of one hundred and fifteen millions of pounds. The estimates of value have materially decreased since 1864. The average for 1865, for the northern States, was $4 50; that of 1866, for all except the Pacific States, is $3 37.

There has been an increase in the number of swine, principally in the west. The number is placed at 24,693,534; in 1865, without the southern States, it was 13,616,875. The average price in 1865 was $8 86; in 1866, $5 43.

G.—Showing the estimated total number and total value of each kind of live stock, and the general average price thereof, for February, 1867.

States.	Horses.			Mules.			Sheep.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	51, 190	$84 74	$4, 338, 299				805, 884	$3 37	$3, 025, 848
New Hampshire	35, 096	84 02	2, 949, 083				623, 371	3 44	2, 145, 955
Vermont	49, 222	77 80	3, 830, 749	42	$113 33	$4, 760	1, 335, 980	3 79	5, 066, 705
Massachusetts	48, 509	92 30	4, 477, 652				199, 033	4 20	836, 436
Rhode Island	6, 828	86 09	587, 823				36, 958	3 65	135, 174
Connecticut	38, 009	75 08	2, 853, 746	105	77 49	8, 137	188, 308	5 39	1, 016, 282
New York	437, 372	96 05	42, 012, 975	2, 139	101 90	217, 964	5, 373, 005	4 55	24, 487, 471
New Jersey	81, 984	109 97	9, 016, 113	7, 793	132 32	1, 031, 185	190, 150	6 31	1, 210, 305
Pennsylvania	404, 555	92 65	37, 484, 070	14, 610	111 28	1, 625, 805	3, 456, 568	4 08	14, 111, 439
Delaware	17, 075	88 36	1, 508, 797	2, 394	103 82	248, 550	17, 600	4 62	81, 437
Maryland	85, 160	88 68	7, 546, 927	11, 293	94 72	1, 069, 732	278, 326	4 58	1, 274, 733
Virginia	172, 547	72 82	12, 565, 008	28, 710	86 88	2, 494, 576	700, 666	2 56	1, 793, 705
North Carolina	99, 436	77 81	7, 737, 550	32, 560	85 29	2, 777, 086	339, 258	1 77	601, 335
South Carolina	43, 808	79 57	3, 486, 022	32, 372	99 65	3, 225, 885	216, 704	2 08	451, 286
Georgia	71, 924	88 10	6, 338, 022	63, 065	104 96	6, 619, 595	346, 017	1 87	649, 831
Florida	7, 680	102 55	787, 629	7, 216	121 93	879, 915	6, 031	2 34	14, 149
Alabama	82, 591	76 73	6, 337, 803	81, 754	108 75	8, 890, 876	276, 507	1 98	548, 868
Mississippi	69, 355	88 79	6, 158, 700	71, 316	99 40	7, 088, 840	253, 895	1 97	503, 346
Louisiana	36, 208	75 81	2, 745, 005	57, 926	52 91	3, 064, 420	87, 908	2 92	257, 487
Texas	269, 680	33 72	9, 094, 825	66, 183	49 38	3, 268, 241	940, 195	2 15	2, 026, 120
Arkansas	89, 502	66 49	5, 951, 787	42, 487	84 08	3, 572, 437	113, 782	2 68	305, 515
Tennessee	254, 111	80 41	20, 435, 399	69, 489	96 82	6, 728, 134	261, 427	4, 77	1, 249, 174
Kentucky	223, 775	73 62	16, 474, 583	59, 752	96 59	5, 771, 611	933, 193	2 95	2, 755, 253
Missouri	287, 157	67 21	19, 300, 747	60, 988	85 06	5, 187, 776	1, 005, 509	2 33	2, 345, 349
Illinois	608, 657	77 74	47, 319, 172	54, 971	94 73	5, 207, 777	2, 764, 072	3 13	8, 651, 545
Indiana	392, 303	72 91	28, 605, 145	23, 410	87 42	2, 046, 713	3, 033, 870	2 43	7, 372, 305
Ohio	546, 524	73 99	40, 440, 254	8, 067	90 06	726, 514	7, 159, 177	3 10	22, 157, 653
Michigan	192, 590	89 39	17, 217, 391	811	102 56	83, 177	4, 028, 767	3 40	13, 728, 023
Wisconsin	206, 037	100 65	20, 738, 855	2, 308	109 45	252, 619	1, 664, 388	3 52	5, 871, 128
Minnesota	49, 770	107 26	5, 338, 582	955	109 84	104, 900	130, 314	3 62	472, 063
Iowa	390, 035	81 53	31, 801, 129	15, 440	97 23	1, 501, 294	2, 399, 425	3 00	7, 198, 276
Kansas	38, 963	67 19	2, 618, 105	2, 863	82 67	236, 695	108, 287	3 28	355, 180
Nebraska	13, 670	85 87	1, 173, 871	1, 367	116 85	159, 740	20, 811	3 61	75, 284
Total	5, 401, 263		429, 271, 818	822, 386		76, 094, 954	39, 385, 386		132, 774, 660
Grand average of prices		79 46			92 52			3 37	

G.—*Showing the estimated total number and total value of each kind of live stock, &c.*—Continued.

States.	Cows.			Other cattle.			Hogs.		
	Number.	Average price.	Total value.	Number.	Average price.	Total value.	Number.	Average price.	Total value.
Maine	129,891	$48 36	$6,281,529	155,541	$40 62	$6,318,293	37,472	$15 39	$576,975
New Hampshire	74,378	....	3,503,947	114,770	39 14	4,492,101	33,208	20 30	674,372
Vermont	172,094	52 25	8,991,916	147,706	38 04	5,619,456	36,196	14 66	530,815
Massachusetts	123,592	59 80	7,390,801	108,118	44 69	4,832,569	44,538	15 43	687,436
Rhode Island	20,581	55 00	1,131,955	20,417	42 29	863,536	12,858	15 74	202,506
Connecticut	123,720	55 50	6,866,460	146,813	40 75	5,983,652	53,401	15 79	843,732
New York	1,324,263	57 22	75,774,329	740,940	39 46	29,240,501	692,140	12 00	8,306,410
New Jersey	137,728	63 25	8,711,296	94,279	44 16	4,164,016	202,260	13 57	2,744,668
Pennsylvania	657,362	47 36	31,132,664	693,351	33 05	22,916,603	1,025,836	8 45	8,678,573
Delaware	17,294	40 00	691,760	37,129	24 74	918,653	38,516	7 75	298,499
Maryland	87,260	41 62	3,632,136	115,623	27 07	3,130,378	383,876	7 00	2,690,561
Virginia	260,698	29 71	7,745,337	282,424	17 08	4,824,615	1,055,945	5 27	5,570,424
North Carolina	203,555	20 05	4,081,278	252,921	9 00	2,639,012	1,160,816	4 40	5,110,492
South Carolina	148,144	22 11	3,275,463	166,657	11 34	1,890,532	299,392	3 96	1,185,940
Georgia	245,033	21 64	5,302,514	338,378	10 56	3,575,974	1,596,536	4 33	6,921,479
Florida	81,958	15 40	1,262,153	174,161	8 16	1,421,900	94,568	2 90	281,340
Alabama	176,271	25 28	4,456,131	233,663	10 22	2,388,341	819,226	4 28	3,512,420
Mississippi	160,580	23 82	3,825,015	240,860	12 62	3,041,994	717,884	4 05	2,912,815
Louisiana	74,930	24 17	1,811,058	152,120	12 59	1,915,342	218,276	5 37	1,173,779
Texas	653,410	11 20	7,318,192	2,458,065	5 59	13,754,042	1,312,556	2 61	3,429,052
Arkansas	100,103	22 77	2,279,345	132,694	10 57	1,403,811	480,864	4 94	2,379,479
Tennessee	183,535	27 88	5,116,956	198,830	14 42	2,868,466	1,317,310	4 10	5,407,566
Kentucky	157,214	39 16	6,156,500	383,928	26 36	10,121,799	1,884,284	4 66	8,790,185
Missouri	281,218	29 86	8,397,170	496,676	19 36	9,616,936	1,354,734	3 78	5,124,279
Illinois	534,236	35 90	19,179,072	922,874	23 48	21,677,443	2,272,640	6 08	13,829,014
Indiana	422,883	38 80	16,407,860	489,759	24 55	12,027,453	2,555,811	4 72	12,082,598
Ohio	683,987	44 94	30,738,373	718,546	36 39	22,015,583	2,206,177	6 37	14,058,861
Michigan	246,158	47 27	11,635,888	313,877	34 23	10,745,446	414,200	6 44	2,667,448
Wisconsin	315,557	38 00	11,991,166	390,834	28 13	10,997,040	386,281	6 17	2,384,318
Minnesota	100,507	36 00	3,618,252	162,783	28 57	4,651,482	144,302	8 42	1,215,380
Iowa	345,113	31 35	10,819,293	599,297	23 90	14,324,096	1,665,575	5 05	8,423,647
Kansas	82,075	32 11	2,635,428	139,428	22 99	3,205,827	127,875	8 05	1,030,355
Nebraska	23,436	34 43	806,901	67,542	26 12	1,764,590	47,981	8 04	386,006
Total	8,348,773	....	322,968,141	11,730,952	....	249,351,682	24,693,534	....	134,111,424
Grand average of prices	....	39 77	....	....	21 55	....	....	5 43	....

H.—*Showing the total value of live stock in the following States for the years* 1860, 1865, 1866, *and* 1867.

States.	1860.	January, 1865.	January, 1866.	January, 1867.
Maine	$15,437,533	$21,539,128	$23,711,811	$20,540,944
New Hampshire	10,924,627	13,560,612	13,862,622	13,836,464
Vermont	16,241,989	24,905,952	27,473,732	24,044,396
Massachusetts	12,737,744	17,638,783	18,263,194	18,224,954
Rhode Island	2,042,044	2,675,029	3,375,917	2,920,994
Connecticut	11,311,079	13,844,574	17,200,930	17,572,009
New York	103,856,296	148,536,690	170,552,506	180,039,650
New Jersey	16,134,693	22,415,429	27,955,185	26,877,583
Pennsylvania	69,672,726	105,862,161	123,847,743	115,949,154
Delaware	3,144,706	3,545,607	4,469,869	3,747,696
Maryland	14,667,853	19,139,655	20,161,813	19,344,467
Kentucky	61,868,237	56,729,634	60,348,250	50,069,931
Ohio	80,384,819	126,978,891	141,215,182	130,137,240
Michigan	23,714,771	47,311,803	52,091,122	56,077,373
Indiana	41,855,539	82,543,704	88,657,071	78,542,074
Illinois	72,501,225	116,588,288	115,459,232	115,864,023
Missouri	53,693,673	44,431,766	49,016,699	49,972,257
Wisconsin	17,807,375	36,911,165	47,635,107	52,235,126
Iowa	22,476,293	66,572,496	71,946,682	74,067,735
Minnesota	3,642,841	8,860,015	12,671,207	15,400,659
Kansas	3,332,450	7,324,659	9,127,306	10,081,590
Nebraska	1,128,771	3,216,312	3,841,164	4,366,352
Total	658,577,284	991,133,353	1,102,884,344	1,079,912,671

The following statement is a comparison of the total value of live stock in the States named, taken from the estimates in table G, compared with the value in 1860.

States.	1860.	1867.
Virginia	$33,656,659	$34,993,665
North Carolina	17,717,647	22,946,753
South Carolina	15,060,015	13,515,128
Georgia	25,728,416	29,407,415
Florida	2,880,058	4,647,086
Alabama	21,690,112	26,134,639
Mississippi	19,403,662	23,530,710
Louisiana	11,152,275	10,967,091
Texas	10,412,927	38,890,472
Arkansas	6,647,969	14,892,374
Tennessee	29,978,016	41,805,695
Total	194,327,756	261,731,028

PRICES OF FARM STOCK IN THE PACIFIC STATES.

I.—*Showing the amount, in tenths, of the farm stock of the States and Territories named in February,* 1867, *compared with the amount in February,* 1866, *and the prices of the same on the 1st of February,* 1867.

States and Territories.	HORSES.					MULES.					CATTLE AND OXEN.					COWS.		SHEEP.			HOGS.		
	Average number compared with 1866.	Average price per head of same under 1 year old.	Average price per head of same between 1 and 2 years old.	Average price per head of same between 2 and 3 years old.	Average price per head of same over 3 years old.	Average number compared with 1866.	Average price per head of same under 1 year old.	Average price per head of same between 1 and 2 years old.	Average price per head of same between 2 and 3 years old.	Average price per head of same over 3 years old.	Average number compared with 1866.	Average price per head of same under 1 year old.	Average price per head of same between 1 and 2 years old.	Average price per head of same between 2 and 3 years old.	Average price per head of same over 3 years old.	Average number compared with 1866.	Average price of same.	Average number compared with 1866.	Average price of same under 1 year old.	Average price of same over 1 year old.	Average number compared with 1866.	Average price per head of same under 1 year old.	Average price per head of same over 1 year old.
California	11.2	$20	$30	$45	$75	10.6	$25	$38	$63	$113	9.2	$8	$15	$27	$39	11.6	$39	12	$2 27	$3 40	14	$5 72	$10 44
Oregon	10.7	24	35	53	97	12.3	30	45	71	113	10.2	6½	11	17	29	10.8	26	12.4	1 56	2 20	10.5	3 00	7 00
Nevada	11.5	20	37	52	95	10.5	45	60	85	130	13	10	18	30	52	12.2	50	11	4 25	5 25	16	12 00	17 00
Washington	......	......	......	......	......	......	......	......	......	......	15	10	18	25	45	12.5	30	......	......	......	11	5 00	10 00
Dakota	12	50	80	100	120	10	40	70	90	150	14	15	20	30	45	14	30	20	3 00	4 00	20	5 00	10 00
New Mexico	......	16	31	51	99	10	22	35	60	103	10	10	16	27	38	......	32	......	1 00	2 37	10	4 00	13 00

There is a wide range of prices for stock in the Pacific States and Territories, depending very much upon the breeds, whether American or Mexican; also whether the prices are paid in currency or gold. The above are *average* estimates.

HEALTH AND CONDITION OF FARM STOCK.

The increasing magnitude of this prominent agricultural interest, and the rapid enhancement of values through judicious crossing and more liberal keeping and skillful management, render important a careful investigation into the condition of farm stock of the country. The increase of disease from want of feed and care, and possibly from deterioration in constitution by injudicious breeding and management, suggests the urgent necessity of examination into its character, causes, and results. An interest involving a capital of fourteen hundred millions, without reference to investments in lands, buildings, and incidentals, demands the watchful care of the public guardians of our national resources.

The winter of 1866–'67 was one of unusual severity, and much loss resulted from insufficient provision of feed, as well as from want of protection against cold and storms. In New England and northern New York, where the thermometer often sinks to 20° and 30° below zero, the loss was small, because the farm stock was well fed and comfortably sheltered; in the northwest the feeding was liberal, the shelter often insufficient, resulting in extensive losses; and in the south, where no winter protection whatever is deemed necessary, losses were general and heavy.

In a land where scarcely half the growth of grasses is depastured, it seems little less than deliberate wickedness, and something more than downright inhumanity, that domestic animals should die by thousands of starvation. Because some winters are so mild that the poor cow shivers through them without actual starvation, whole communities leave their cattle to shift for themselves every winter, until one of such severity as the last takes pity on their misery and mercifully ends it. The loss from actual starvation and exposure the past winter has been extraordinary.

In some counties in Texas it is estimated that one-tenth of the cattle died from exposure; in Hall county, Nebraska, a similar proportion was reported; in Mississippi county, Arkansas, "one-fourth died of starvation in consequence of inundation;" and in Houston county, Minnesota, where no disease existed among cattle, many died for lack of proper feeding. Within a day's ride of this city, in Virginia, cattle could be seen in January wandering hopelessly in search of food through snow a foot deep, and hogs burrowing in snow-banks, day after day, with the mercury nearly at zero. In any single day's journey from Virginia to Texas might be witnessed similar exposure and starvation.

The following inquiries have been addressed to the regular corps of statistical correspondents:

"Has there been any prevailing disease among cattle in your county during the past year? If so, what disease, and to what extent?

"Has the Spanish fever prevailed among cattle in your county? If so, when did it appear, what has been the loss, and what method of treatment has been followed?

"Has the hog cholera prevailed? If so, what has been the loss, and what remedies employed?

"What diseases have prevailed among sheep, and to what extent?

"Has any unusual disease prevailed among horses?

"In what condition have sheep come out of winter quarters?"

The returns were general and full. They indicate a favorable sanitary condition of farm stock, while revealing disease and resultant loss, in particular localities, sufficient to excite apprehension and stimulate vigilance in applying that prevention which is always so much safer and cheaper than attempted cure. Small as such percentage of loss may be, the aggregate would astonish the farmers of the country. Cattle have suffered less from disease than any other kind of live stock. Horses stand next to cattle in sanitary condition. Sheep have been attacked by a variety of diseases, including starvation, and the conse-

quent fatality has been considerable. Swine, always more subject to disease than any other farm animals, have been as unhealthy as ever during the past year. The widely prevailing hog cholera has claimed its victims by thousands, and has been scarcely excluded from any section of the country.

DISEASES OF CATTLE.

Exemption from disease has been quite general in the eastern and northwestern States, and few losses from maladies of whatever character are reported; nor has there been any widely prevailing epizootic among the cattle of the west and south. The diseases reported are pleuro-pneumonia, the so-called Spanish fever, abortion, horn-ail, bloody murrain, "black-leg," "distemper," "swelled brisket," and maladies with no name or well defined symptoms.

Pleuro-pneumonia.—This disease is reported in Newport county, Rhode Island; in Kings county, New York; in Hudson county, New Jersey; and in Bucks county, Pennsylvania. Our correspondent in Newport, Rhode Island, says: "The cattle disease called pleuro-pneumonia has prevailed in this county to a limited extent for the last three or four years, but it has been considered exterminated several times since its first appearance here. From the best information I can get, I think about ten head of cattle have died of the disease in this county the past year, and probably some thirty more have been sick with it, and have recovered so far as to be fatted for beef. I have heard of no new cases for the last four months, and I hope we are now rid of it in this county. To prevent the spread of the disease, we have kept isolated all cattle known to have been exposed to it until danger of contagion was past, by which means it has been kept within narrow limits."

In Baltimore county, Maryland, a prevailing disease is reported, which is called "lung fever." It originated in the vicinity of Baltimore, and has spread considerably. In several dairies, numbering from twenty to eighty cows, heavy losses have occurred; in one, thirty cows; in another, twenty; in others, ten to fifteen cows. Various opinions relative to the disease and its treatment are entertained, with little agreement, except as to its contagiousness and the necessity of isolation. Few symptoms are reported by which to decide how this differs from pleuro-pneumonia, or whether it may be identical with it. The animal refuses food when taken sick, and the milk secretion ceases; the lungs are found to be much decayed.

Abortion.—This disease has prevailed to some extent in the dairy districts of New York, and in Washington county, Vermont; one or two cases in a herd of twenty cows are common, and in a few instances half the herd have aborted.

Hollow horn.—Several places report the existence of "hollow horn." In Fayette county, Indiana, as a correspondent reports, "it is very common at this season of the year, especially with milch cows, of which one-fifth of the number are affected." In Lawrence county, Alabama, it is reported; in Troup and Houston counties, Georgia; in Lorain county, Ohio; and in Whitley county, Kentucky.

Various diseases.—In Park county, Colorado, a disease known there as "swelled brisket" has occasioned twenty to thirty deaths.

In Barton county, Georgia, and Jackson and Emmet counties, Iowa, losses from "black leg" are common.

Bloody murrain is prevalent in Harford county, Maryland, where fifteen cases and eleven deaths have occurred; in Gloucester county, Virginia; and in Clay county, Alabama. In Gloucester county, Virginia, it is stated that "four-fifths of those attacked die," and that "the loss is about ten per cent., one year with another." The estimate of loss is scarcely credible, if it is meant that a tenth of all the cattle of the county die annually from this cause.

In many places diseases are spoken of under the vague terms "murrain" and

"distemper." In many cases reported, particularly in the south, these words are common. "Murrain" is prevalent in Barton county, Georgia; in Stokes and Lincoln counties, North Carolina. In Towns county, Georgia, "cattle pastured with cattle from the south take the murrain and invariably die, though those brought from the south do well," (indicating the identity in these cases of "murrain" and Spanish fever.) In Caldwell county, North Carolina, "a disease among cattle known as 'distemper' proves fatal in nearly all cases," while in some cases the words "murrain or distemper" are used.

In Tippah county, Mississippi, the "dry murrain" prevails every autumn to some extent.

A correspondent in York county, Virginia, says that "cattle brought into the tide-water region of the southern States are subject to bilious dysentery, which proves fatal in most cases."

A correspondent in Buchanan county, Iowa, says: "A disease has prevailed among cattle in the southern part of this county during the latter part of the winter and this spring. The animal is taken with weakness in the fore-legs, heaviness of the eyes, which are much sunken, then a gurgling sound in the wind-pipe and discharges at the nose, gradually declining until death. Tar has been used as a remedy. About three per cent. have died in that vicinity. The cattle in other parts of the county have not been affected."

Dr. G. M. Brown writes of a disease among cattle in Cumberland county, Virginia, which has prevailed at times for twenty years past, under the names, "Carolina distemper," "cattle plague," and "bloody murrain." He is inclined to consider it identical with rinderpest; but, from the description he gives, it is evidently not the cattle plague of Europe, which has never prevailed in this country. When it *does* appear, it will not be twenty years in making itself generally known.

SPANISH FEVER.

The disease known in a certain belt of country by this appellation, and sometimes as Texas fever, has proved exceedingly fatal, and has excited great apprehension in States in which it has ever raged; and in many cases it has aroused the hot indignation of stock growers against Texan cattle drovers, who have been threatened with combined armed opposition, and compelled to desist from the prosecution of their trade.

Few observers of this disease are qualified to describe its symptoms with sufficient accuracy to enable one to judge of its precise character. Indeed, it is probable that the most scientific medical men, after careful and skillful examination, might differ widely in their conclusions. Our correspondents have furnished much information of a general character, not at all contradictory in the main facts, but by no means full in description of the symptons.

It has been assumed by some to be identical with rinderpest. The assumption is utterly erroneous. The Texas cattle, in whose path of migration the local herds receive the subtle infection and sicken and die without remedy, are themselves exempt from outward signs of disease, while communicating a deadly poison to others, apparently through the excrementitious matter which they leave in their track. This is by no means a characteristic of rinderpest. In this Spanish fever the infected beast, according to these returns, generally has an appetite and eats regularly during the progress of the disease; in rinderpest, on the contrary, the appetite is irregular, capricious, and then entirely lost. In the former, in some cases if not always, the bowels are open; while in the dreaded cattle disease of Europe constipation is the rule, succeeded in the progress of the disease by dysentery. In the Spanish fever there are discharges from the nose, as the disease progresses, of a greenish matter, which may or may not be similar to the greenish yellow and somewhat dense granular deposit upon the nasal orifices in rinderpest.

The duration of the Spanish fever is variable. It appears to reach a fatal termination, in some instances, in two or three days; in others, a week; in others still, ten or twelve days.

It is a singular fact, not only that the migrating herds improve in condition while disseminating the disease, but that such disease does not prevail, if it even exists, in the localities from which the cattle originate. Yet their bodies must contain the germ of disease, the virulent animal poison which is communicated by their excretions to the pastures upon which their victims feed after them.

The conditions necessary for the development of this poison are found in the latitude of southern Kansas and Missouri, in the more elevated sections of Arkansas, in parts of Tennessee, in southern Kentucky, in North Carolina, and the hill lands of Georgia and South Carolina. It is not reported further north than southern Illinois, and not known in Ohio, Pennsylvania, or Maryland.

A convincing proof that its development is referable in some way to climate is shown by a fact mentioned by a correspondent of its existence in the mountain lands of Georgia, generated by removal scarcely fifty miles away from the low lands.

That it is not produced by travel is evident, else cattle driven from Iowa to Ohio should sometimes show symptoms of it. More conclusive still is the fact that Texas cattle driven to New Orleans do not communicate the disease to the cattle of Louisiana. A correspondent mentions a fact which may be regarded as a marked corroboration. Eight hundred Texan cattle were last season driven into Mississippi county, Arkansas, and were scattered through the county without producing disease. This county lies in a latitude sufficiently high to awaken an expectation of a fatal result of such a migration; but it is on the Mississippi river, in a miasmatic region. It is possible that this suggestion covers the reason for the non-development of the disease.

A response from Colonel J. Wilkerson, a man of experience and good judgment, of Athens, Georgia, published in the Southern Cultivator, shows that the same disease attends the migration northwards of Florida cattle. The following comprises the substance of the communication:

"I have been a cattle dealer for twenty-five or thirty years, and in that time have had many a death among my stock by this disease, and have in consequence taken some notice, meanwhile endeavoring to learn its causes and how it was brought about. I notice that cattle scarcely ever take the fever if let remain where they were raised, and I am fully convinced it is generally brought on by a change of climate. For instance, you take cattle from the mountain country to the low country and they will take the fever in a short time and die, but their disease will not affect the cattle raised there; but, on the other hand, take cattle raised in what we call a distempered part of our country—that is, the low country—from warm latitudes, up into a colder one, they will themselves improve all the time; but, without being sick themselves, they will spread the fever and kill the cattle in the section of country into which they are taken, till they travel on, or stay or have staid long enough for the fever to leave the system. I have been in the habit of driving cattle from Florida to Virginia, and found my cattle to improve and do well; but after I passed the line of 34 degrees, they began to spread the fever all along the line of travel among the stock raised in that section of the country, till I struck the line of Virginia, which is a distance of about 250 miles, then it ceased, and all went on well. I suppose the reason for its stopping was, that my cattle had been out of the low country long enough to become acclimated. Hence, I think the disease is originated from a change of climate, either from a colder to a warmer climate, or taking them from a warm climate to a more cool and healthy one. How it is that they carry the disease with them, and give it to others without injury to themselves, is a mystery I am not able to solve, and will leave that to be discussed by the bureau of investigation."

Correspondence from Texas fully corroborated the common assertion that the disease is not found in Texas, and showed that cattle epidemics are practically unknown there. Not a few Texan farmers were inclined to believe the disease a myth, or a story told to injure the sale of their cattle; yet the farmers of Kansas and Missouri have suffered severely from its effects. The following places, among others, have been afflicted with it:

Linn county, Kansas.—The disease was prevalent during summer and fall.

Butler county, Kansas.—Cases reported, 141.

Osage county, Kansas.—Loss, $5,000. Not one in twenty recovered. Disease confined principally to the Santa Fé road. Blooded stock were more frequently attacked, and rarely recovered. The cattle of Burlingame, ranging north over the trail, nearly all took the disease and died; those that ranged south, away from it, were exempt.

Leavenworth county, Kansas.—Four visitations in seven years have resulted from arrivals of Texan cattle in three or four weeks after their appearance.

Woodson county, Kansas.—"Some farmers lost all they had, and no less than thirty per cent. of the cattle have died."

Douglas county, Kansas.—In this locality Texan cattle died during the winter, apparently from the severity of the winter. It is not stated that the disease was communicated to other stock.

Fort Scott, (Bourbon county,) Kansas.—The Spanish fever commenced in May and continued all summer. "Texan cattle did not appear to suffer any ill effect from the disease, but fully one-half of the native cattle in the county died with it."

Franklin county, Kansas.—Three visitations have been experienced in ten years, always when cattle are driven in droves in hot weather. "In the cattle which have died of this fever," the report says, "the manifolds are as hard as a pressed cotton bale."

Howard county, Missouri.—A few cases along roads over which Texan cattle were driven. No treatment was instituted, and all died.

Cass county, Missouri.—Two per cent. of all the cattle in the county died of the disease.

Callaway county, Missouri.—The disease did not spread from the farms on the roads travelled by Texan cattle.

Christian county, Missouri.—Disease was very fatal, but did not spread.

Newton county, Missouri.—Fever prevailed from July to October. Many droves were stopped until fall, but no sign of disease appeared among the Texan cattle.

Chariton county, Missouri.—Loss about sixty. Nearly all attacked died in a short time.

Cedar county, Missouri.—Seven-eighths of those attacked die.

Oldham county, Kentucky.—The disease appeared in June, introduced by Texan cattle. "I have had the disease in my herd twice," a reporter says: "the first time I lost 150—nearly all I had."

Fayette county, Kentucky.—The disease broke out in a herd of Kentucky cattle bought at Lexington. It was subsequently ascertained that they had been on a road travelled by Texan cattle. It did not spread.

Perry county, Illinois.—The disease appeared in July among cattle pastured on ground previously occupied by Texan cattle.

DISEASES OF HORSES.

Horses have suffered comparatively little from disease during the past year. Very few cases of disease are reported from New England. In the middle States reports of glanders and lung fever are made from a few counties. In the South there is more complaint of glanders than elsewhere, every State having

been afflicted by it—in some places with great severity—early last season. This disease seemed to be a legacy left by the war; but it is now rapidly disappearing. West Virginia, Michigan, Minnesota, Iowa, and Kansas appear to be nearly free from disease; while the central States of the Ohio valley furnish occasional instances of glanders and lung fever. In Texas several counties have suffered from "loin distemper," which does not affect geldings, though both sexes are subject to it.

In Addison county, Vermont, an unusual disease made its appearance, introduced by a span of fine horses from Boston. A correspondent says: "The horses must have taken the disease on the cars, for they left no traces of it in the stable from which they came. It was but a few days since that I learned anything of it; it is represented as taking the flesh off rapidly. It passed through a stable of twelve horses, owned by the man to whom the Boston horses were sent, and has now made its appearance among the horses of his near neighbors. I do not learn that it has proved fatal in any case. Its name and character, as well as treatment, are yet to be developed."

In Morris county, New Jersey, several horses died "from a disease supposed to be pleuro-pneumonia." All the cases proved fatal.

In Jefferson county, New York, a "horse distemper" is prevalent, but not very fatal.

A mortality, estimated at one-third of the colts foaled this spring, in Ozaukee county, Wisconsin, is reported. The disease is attended with swelling of the joints.

In Grant county, Wisconsin, there have been instances of a disease of the eye.

The "big-head" prevails among horses in Pulaski county, Illinois.

In Clinton county, Illinois, about two hundred of the best horses "have died of a new disease. The horse becomes very sick, with quick breathing and pulse, and cold extremities, followed by death in twenty-four hours. No remedy has been found." A loss of eighty-seven horses from "big-head" is reported in the same county.

In Miami county, Ohio, a fatal disease prevailed last year, but horses are now healthy.

In Van Buren county, Michigan, deaths have resulted from a disease attended with swelling of the legs, head, and jaws, and with running sores.

Colic has proved fatal in St. Charles county, Missouri.

In Knox county, Kentucky, a fatal disease has prevailed "without any perceivable cause."

Lock-jaw and "lung disease," fatal in a few cases, are reported in Kent county, Delaware.

In Henderson county, Illinois, many horses have died—thirty in Oquawka—from a disease which appeared to be contagious. It was supposed to have originated in a pasture of new bottom land.

In Racine county, Wisconsin, a disease, somewhat resembling diphtheria, attended with a swelling and inflammation of the glands, and great prostration, has been prevalent. It generally yielded readily to remedial measures.

In Barton county, Georgia, several horses and one hundred mules died from blind staggers. There was a considerable loss of horses, "mostly for want of corn," while in Taylor county, Georgia, and Yalabusha county, Mississippi, many horses and mules died in consequence of feeding on "shipped" or "up country" corn, which had been damaged.

DISEASES OF SHEEP.

Sheep have suffered more from disease the past year than usual—more than cattle or horses, but less, probably, than hogs. The rot, formerly almost unknown in this country, is becoming quite too common for the comfort of wool-growers;

yet few reports of this disease have been received, except from the south. New England presents a clean bill of health, except in some sections of Vermont and Massachusetts, where foot-rot and grub in the head are reported. In New York, either grub, foot-rot, "hoof-ail," black tongue, scab, or other diseases are found in nearly one-third of the counties represented. In the west, scab is more prevalent, and very common in the south, particularly in Texas. Nearly half of the counties of Iowa report some form of disease, of which scab is the most common, with occasional mention of "yellows," "dropsy," and grub.

Poverty and exposure have done their work in many sections of the south, and, to some extent, in the west. In the most northern States, the sheep have wintered best; in the most southern, as Texas, the loss from exposure has been greatest. There is no doubt that the cost of adequate shelter for all the unsheltered sheep of the country could be easily defrayed by the value of sheep and lambs killed by exposure during the past winter. The severity of the season has been an expensive lesson to wool-growers in low latitudes, which will be worth its cost if it shall result in ampler protection and more liberal supplies for the rougher periods of a fickle climate.

The following epitome of correspondence will illustrate the various tenor of the information received:

Berkshire county, Massachusetts.—One in every twenty have the foot-rot.

Forest county, Pennsylvania.—A very destructive disease prevailed among sheep, whereby one-third died. Disease not known, but it appears to be something like consumption.

Niagara county, New York.—Grub in the head prevails; one flock lost one hundred; others ten to sixty.

Kent county, Delaware.—Rot exists in this county, and there has been a loss of young lambs from exposure.

Clinton county, Iowa.—Half the lambs lost from cold storms.

Miami county, Ohio.—Fifteen per cent. loss in wintering.

Lorain county, Ohio.—Heavy losses have resulted from rot. Livers light colored and quite rotten.

Hardin county, Ohio.—Old sheep have done well, but half the lambs were lost.

Medina county, Ohio.—Sheep are in poor condition; one man lost one hundred—half his flock; another eighty; others sixty each. In this county 8,000 perished in the cold storm of June last—535 in one township.

Nicollet county, Minnesota.—Six per cent. loss from rot.

Livingston county, Illinois.—Losses of 200 to 300 head are reported.

Lycoming county, Pennsylvania.—"Two and a half per cent. of our sheep died, attacked with a swelling under the jaw. They moped around four or five days and died."

Madison county, Virginia.—"The rot has prevailed among the sheep. In some cases entire flocks have been destroyed. The loss has been excessive. No remedy."

Polk county, Tennessee.—Rot has destroyed three-tenths of the sheep.

Attala county, Mississippi.—"Sheep die from eating sneeze-weed. What is the remedy?"

Collin county, Texas.—Two-thirds of the sheep of this county have died with the scab, or from exposure.

Houston county, Texas.—Three-fourths of the lambs have perished.

Bell county, Texas.—Sheep and lambs have died from exposure.

Blanco county, Texas.—Some flocks have lost half from exposure.

Conecuh county, Alabama.—One-tenth lost by the rot.

Guthrie county, Iowa.—The sheep of this county are dying off rapidly. The first symptom noticed is a general weakness or giving way of the limbs, followed soon after by death, mostly among the rugged and robust sheep. After death the carcass is found full of small, mattery, white pimples.

Niagara county, New York.—Scab and foot rot prevail to some extent, and are on the increase.

DISEASES OF HOGS.

Almost all the diseases of swine seem to be popularly resolved into "hog cholera." Of all diseases of domestic animals, those of this genus are evidently less thoroughly understood than those of any other farm stock. Ideas on the subject are in a singular state of confusion, and remedies are countless in number and most incongruous in character. If the symptoms were accurately noted, it would probably be found that several kinds of "hog cholera"—as every prevalent disease of the hog appears to be called—are uniting in the mischief produced.

The New England States report no hog cholera, except a very little in Middlesex county, Massachusetts; New York has but little; several counties in Pennsylvania are afflicted; in the southern States half the counties report it, Georgia, Mississippi, and Tennessee having very few counties free from its influence; while the valley of the Ohio is overrun with it, Ohio suffering less than the other corn-growing States, and Michigan and the northwest nearly exempt.

In one locality in Tennessee erysipelas is named as an additional cause of loss, and "black tooth" in Wisconsin, and measles in North Carolina.

An idea of the alarming aggregate of loss may be gained by a reference to a few of the items showing the proportion, value, or number of the stock lost in separate counties. These, it is true, are selected from the worst cases, as follows:

Cambria county, Pennsylvania.—Sixteen per cent. died.

Floyd county, Virginia.—Three-fourths of the hogs died.

Cherokee county, North Carolina.—One-third died.

Marion district, South Carolina.—Loss twenty-five per cent.

Taylor county, Georgia.—Loss twenty per cent. In some former years fifty per cent. Farmers have almost abandoned hog raising. If one recovers, it costs more to fatten him than he is worth.

Clay county, Alabama.—One man, with a herd of 174, lost all but eighteen.

East Feliciana parish, Louisiana.—Loss twenty-five per cent.

Union county, Tennessee.—Seven hundred died, valued at $5,600.

Jefferson county, Iowa.—Loss fifteen per cent.

Alexander county, Illinois.—Loss fifty per cent.

Clark county, Missouri.—Loss fifty per cent.

Kenton county, Kentucky.—Loss 4,000 to 5,000.

It is unnecessary to continue the enumeration. In Kentucky the estimates of loss in different counties range from three to forty-five per cent. In Rock castle county the damage is placed at $10,000.

Indianapolis, Marion county, Indiana.—Our correspondent (Fielding Beeler) believes that twenty per cent. of all the pigs produced in the last five years have perished from disease before reaching the pork barrel. He doubts the existence of any certain remedy, but thinks some of the agents employed may act as preventives.

DEPREDATIONS OF DOGS.

The losses suffered by wool-growers from the depredations of dogs have been so serious and so constantly and loudly deplored that special effort has been put forth to ascertain the damages incurred. Every attempt to aggregate them reveals astounding facts. Returns have been received in this department during the year from 539 counties, in every State in the Union except those upon the Pacific coast, showing an aggregated estimate of 130,000 sheep killed by dogs in about one-fourth of the whole number of counties. On this basis the total

number killed would be more than half a million yearly. Then the number injured, assuming as a basis the proportion reported from actual count in a series of years in Ohio, would be more than three hundred thousand more; *more than eight hundred thousand sheep killed or mutilated yearly, and a two per cent. tax levied upon the total investment in sheep, a loss equal to one-third of the gross income from six per cent. stocks.*

Are these assumptions warranted by facts? Let the reader examine data obtained at different times from various sources under different auspices. In Missouri the aggregate of estimates of sheep killed in thirty-three counties is 8,267; in 1866, in answer to a similar inquiry, returns were received from thirty counties, which gave a total of 7,911. Boone county, Kentucky, at the same time, furnished an estimate of 3,000 killed; and from counties in Michigan, Iowa, and Pennsylvania, estimates of 1,000 or more in each were received. The southern and frontier States show greater losses in proportion to extent of flocks than more central regions. The reason is plain—there are more dogs under fewer safeguards. In many of these localities wool growing is attempted and abandoned for the sole reason of these unchecked ravages.

By actual enumeration, without counting those not reported and paid for under existing law, Ohio reported in five years 203,824 killed, averaging 40,764 per year, more than one per cent. of her flocks, while the injured were about two-thirds of one per cent. With a very small allowance for a higher percentage of loss, where it is shown to exist, an estimate is rounded out upon this Ohio basis of eight hundred thousand sheep killed and injured among the forty millions of the United States.

The loss in 1862, in New York, as estimated by the secretary of the State Agricultural Society, was 50,000 sheep, valued at $175,000. This involves a higher average than the Ohio figures.

The following table gives the aggregate result of recent returns, not including the damage done to sheep maimed or otherwise injured:

TABLE K.—*Showing the number of sheep killed by dogs in* 1866 *in certain counties of the several States, as estimated by correspondents of the Statistical Division.*

States.	No. of counties reported.	No. of sheep killed.	States.	No. of counties reported.	No. of sheep killed.
Maine	8	1,945	Texas	16	7,360
New Hampshire	6	854	Arkansas	9	770
Vermont	5	495	Tennessee	25	12,478
Massachusetts	5	713	West Virginia	15	1,475
Rhode Island	2	300	Kentucky	26	8,292
Connecticut	3	380	Missouri	33	8,267
New York	25	3,645	Illinois	60	16,167
New Jersey	6	409	Indiana	33	7,189
Pennsylvania	28	6,155	Ohio	31	13,532
Delaware	2	550	Michigan	18	4,058
Maryland	5	1,154	Wisconsin	26	2,237
Virginia	17	4,272	Minnesota	8	518
North Carolina	24	8,582	Iowa	35	4,660
South Carolina	7	1,240	Kansas	13	2,212
Georgia	18	3,077	Nebraska	3	125
Florida	2	55	Utah	2	14
Alabama	11	2,172			
Mississippi	9	4,600	Total	539	130,427
Louisiana	3	475			

If these returns are indicative of the actual extent of the injury—and they are evidently lower than the reality, because based upon partial and imperfect local returns—the loss to the country yearly is not less than half a million sheep. Three years ago their value was estimated at five dollars each. If we reduce the estimate, to suit the diminution of values, to four dollars each, the direct loss on account of sheep killed amounts to two millions of dollars yearly. The official statement for Ohio, in 1866, was as follows: Killed, 31,118, valued at $112,367; injured, 21,681, valued at $41,729.

In view of the official and unofficial exhibits of different States and localities, and the direct returns to this department, from all sections of the country, for two consecutive years, the direct losses of 1866 may be stated as follows:

500,000 sheep killed	$2,000,000
300,000 sheep injured	600,000
Total	2,600,000

The cost of keeping dogs, most of them utterly worthless, when calculated for the whole country, assumes startling proportions. The estimate made in the report of 1863, of $10 per annum, or less than one cent per meal, cannot be considered extravagant, "in view of price paid for boarding dogs, the cost of keeping large numbers of them in cities, and their exclusive consumption of meat." As to their number, it is believed by many that they will average one to each family, or seven millions in the United States. In cities and towns that average would not be reached, while many a pack of hounds and assemblage of curs of low degree might be found in the ownership of single families. Possibly seven millions may be too large. Ohio, with half a million families, is supposed by many to have half a million dogs, although little more than one-third of that number are found on the assessors' books. It may be assumed, in view of all the data obtained, as a low estimate, that there are five millions of dogs in the United States, and that their subsistence involves an *expenditure of fifty millions of dollars.*

In the vicinity of cities sheep have been almost exterminated. In some sections of Ohio, and other parts of the west, wool-growing has been greatly discouraged from this cause. The south is acknowledged to be especially adapted to profitable wool production, and the business would rapidly increase there but for the interference of dogs. Official correspondence is replete with evidence of this. In Somerville, Tennessee, "sheep have decreased one-half since February," it is said, and "fully one-half are killed by dogs, and the other half are eaten up." "Sheep-raising," in Beaufort, N. C., "would be profitable were it not for the ravages of dogs." In Pontotoc county, Mississippi, the annual loss from dogs is placed at 900 sheep. In St. Francis county, Missouri, "at least fifteen per cent. of the flocks are destroyed by dogs." In Wayne county, North Carolina, very fortunately "the United States forces, while in occupation, very nearly exterminated the stock of dogs, and, as a consequence, sheep have suffered very little from their depredations."

WAGES OF FARM LABOR.

Towards the close of the year 1866, systematic and general inquiry was instituted for the purpose of ascertaining the average rates of wages paid for farm labor in each county in the States. Twenty years ago, when Robert J. Walker was Secretary of the Treasury, a series of inquiries was addressed to a few individuals in different sections of the country, mainly referring to manufactures and

the tariff, yet embracing one relating to this subject, which was generally ignored in replies, or answered very vaguely, affording no conclusive information on the subject. So far as known, no similar effort was ever made, although statisticians have made estimates from the best data attainable.

The returns to the circular sent out from this department were remarkably full, numerous, and satisfactory. It was deemed best not to load it with too many inquiries, or those difficult of prompt and universal answer. It embraced fifteen separate inquiries relative to farm labor, by hand or machine. A deep interest in the subject, with a proper appreciation of its importance, was manifested by correspondents, who replied with promptness and intelligence, after consultation with the best judgments in their vicinity. In a very few cases where any misunderstanding of a single point apparently existed, the difficulty was cleared up by correspondence. The extent and completeness of the work may be inferred from the number of returns, mostly representing counties, though occasionally subdivisions of counties; and each one of these returns compiled in accordance with the combined judgment of several local correspondents, or other individuals. Ohio, for instance, is represented by 114 returns; Indiana by 110; Illinois by 103; Iowa by 104; New York by 109; Pennsylvania by 75; smaller States by a less number; in all, 1,510 formal statements, each made up of several others, unsually representing a defined territory or district.

Very general returns were received from the southern States, yet fewer than from the northern. These States rest under the disadvantage of a disturbed condition of labor relations, resulting from the war and the manumission of slaves. Assuming as a truth the proposition of Mr. Amasa Walker, that involuntary servitude is not labor, it might be declared that labor in the south has scarcely progressed beyond the period of helpless infancy. Low rates of wages are, therefore, returned from this section. The multiplicity of modes of contracting for service of freedmen, involving, in some cases, semi-partnerships or shares in the products of labor, and in others total or partial supplies of food or implements of labor, renders it difficult to report with accuracy its actual market value. Yet the result of the inquiry has been, upon the whole, quite satisfactory.

The average rate of wages, as given in the accompanying tables, viz: $28 for labor of whites, and $16 per month for that of freedmen, was obtained by careful and laborious calculation. First, the average monthly wages in a State was multiplied by the number of farm laborers in such State, and so with each member of the Union. Then the sum of the aggregate monthly wages was divided by the aggregate number of laborers, giving as a quotient the proper average monthly pay of the farm laborer. An average of the several State averages, it will readily be seen, would by no means answer the purpose of approximate accuracy, as such a mode of *miscalculation* would give to a State with few laborers as much influence as one with many.

As an example of uniformity in a populous, central, prosperous belt, interlaced with railroads and traversed or skirted with navigable water, let the reader note the figures for the States on the fortieth parallel. The monthly rate of wages, without board, is placed at $29 91 in Pennsylvania, $28 46 in Ohio, $27 71 in Indiana, $28 54 in Illinois, $28 34 in Iowa. The east is subject to a somewhat higher cost of living, while in the west the scarcity of labor has the same tendency to advance prices. This scarcity in Nebraska pushes the rate to $38 37. The rate of wages, with board, is still more uniform; Pennsylvania, $18 84; Ohio, $18 96; Indiana, $18 72; Illinois, $18 72; Iowa, $18 87; showing an entire range of variation in the net price of labor of only twenty-four cents!

The result shows an increase of the rates of wages in five years amounting to about fifty per cent. This is less than the increase of the cost of living; still the purchasing power of a month's wages is probably greater than in any other country in the world. Farm laborers, especially in the west, can enjoy more of the comforts of life, and attain a higher rank in the social scale, than those of

any other country. They do not obtain the wages conceded to mechanics and other classes, perhaps better entitled to be considered skilled laborers, yet they enjoy an advantage, which is a partial compensation, in lower rents and cheaper subsistence supplies, and fewer temptations to extravagance and waste.

In view of the superior condition of the class, in comparison with rural laborers in other countries, it is not strange that the European peasant should covet such advantages, and seek them even at the expense of exile from the fatherland.

It is a suggestive fact that the immigration of millions of foreigners has not, as native laborers once feared, proved a serious competition, reducing the rate of wages. On the contrary, it has advanced great public works which have opened new and wider fields of industry, and has pushed the native laborer into the artisan ranks and the sphere of skilled labor, with higher wages, more exercise of mind and less of muscle than before. When it is remembered that in 1860 there were 4,136,175 foreign residents, and at least 5,000,000 at the present time, or one-seventh of the population, and a still larger proportion of the actual labor of the country, this result must be acknowledged to be convincing evidence of the great resources and vast power of labor absorption possessed by the United States.

More than thirty years ago Mr. H. C. Carey made the following estimate of the average of agricultural labor in this country: "Agricultural labor has not varied materially in these forty years in its money price; but the variation that has taken place has been in its favor—the wages of men having been very steadily about nine dollars per month and their board; but higher wages are now not very unusual." The average for white labor at the present time, as presented in the accompanying tables, is fairly stated at $28 per month, or nearly $15 50 and board. This indicates an advance of seventy per cent. in the lapse of a generation, mostly in the last six years, or fifty per cent. since 1861.

Causes and results of high rates.—In those States in which regular labor is most general among the inhabitants, and where it is prosecuted in greatest variety, there will wealth abound and prosperity be most generally enjoyed. And another fact relative to such States will also be noted—their laborers receive the highest rate of wages.

Massachusetts has a poor soil, and cannot be considered a farming State. In 1860 the United States census returned 45,204 farmers, and 17,430 farm laborers, while the total return of all occupations was 454,632. The State census of 1865 makes the number engaged in agricultural pursuits 68,636, and those employed in manufacturing 271,241. The employment of all this labor in commerce, in fisheries, in manufactures, in the mechanic arts, and in trade, requires a consumption of farm products far greater than the home supply. This enables farmers to select those branches of their business most profitable under the circumstances, and least affected by foreign competition, as the milk trade, the fruit supply, and production of perishable vegetables. The facility of obtaining employment in other occupations gives the farm laborer a material advantage, and enforces his demand for higher rates of labor. The result is, at the present time, higher monthly pay than any other State in the Union, except California, viz: $38 94 per month for farm labor, without board. And while the necessaries of life are also high, there is no State in which the agricultural laborer enjoys the comforts of life to a greater extent, or is better fitted to act a creditable part in his sphere in society.

The advantages of a great variety in industry are manifold, one of the highest of which is the fact that all classes and capacities, young and old, male and female, are furnished with something to do, and with a motive for doing it, and thus labor in some form becomes the rule, to which there are few exceptions. Consumers and producers are at each other's doors, or commingled in the same household, and carriers and go-betweens absorb but a small portion of the profits of industry. There is no glut of the markets from excess of production or the deficiency or great expense of transportation. There is no occasion to sell corn

for ten cents per bushel, or eggs at six cents per dozen, or cattle, as in Texas, at five dollars per head.

It is fashionable in communities with but one prominent industry to decry the promoters of these industrial enterprises as monopolists and heartless oppressors. Thirty-eight dollars per month for farm labor, and twenty to thirty for light employments of females, are sufficient answers to such ill-natured charges. Tidy and well-furnished houses, and evidences of refinement in humble life, are not the concomitants of the oppression and tyranny of capital. These same communities must adopt the same variety in industry which they might have done and should have done many years ago, or the compulsive idleness and resultant poverty of large masses of their people will continue, and become intensified and chronic, until their whinings over the prosperity of more industrious communities shall become an obvious wail of misery.

This path of progress has been equally open to all; laws supposed to favor a diversified industry have been applicable to all States alike; the best water-power and the cheapest coal are in States that make no extensive use of either; milder climates and superior facilities for cheap transportation have furnished advantages that have not been transmuted into net profits; and yet such communities, daily inflicting irreparable injury upon themselves, by neglecting the gifts of God and spurning the labor of man, are wont to deem themselves injured by the prosperity flowing from superior industry and a practical political economy.

Will States that are almost deserts from a suicidal policy of growing agricultural products for exportation, and importing everything, learn wisdom from poverty, and grow prosperous and wealthy, with laboring classes comfortable and intelligent, and advancing in moral and mental culture?

The rate of wages in the several States differs just in proportion to the multiplication of separate industries, modified in new States in process of settlement by the increased demand for consumption occasioned temporarily by in-coming settlers who are as yet non-producers, or in the mining States and Territories by the employment of the majority in mining. The following is a table of average wages per month of farm laborers employed for the year, in the different sections of the country:

Eastern States	$33 30
Middle States	30 07
Western States	28 91
Southern States	16 00
Oregon	35 75
California	45 71

One cause of high rates of labor in this country is the superior intelligence and activity of the laborers. Nowhere else is so much agricultural labor done by machinery requiring skill and knowledge in its management, and accomplishing marvellous results in its swift and efficient action. An English writer on political economy recognized this element of increase in labor rates when he said: "The average annual wages in England is three times as high as in Ireland; but as the laborer in Ireland is said not to do more than one-third of what is done by the laborer in England, the price of labor may in both countries be about equal." There is a tendency to a just equilibrium in the labor markets as in all other markets; and if laborers by superior skill and celerity of movement may do double work, they will obtain, other things being equal, a double price. Agricultural machinery has done more in this country than any thing else towards the elevation of labor.

L.—*Showing the average rate of wages of agricultural labor per month, when employed for the year, from returns from statistical correspondents, county clerks, and county auditors, made in December, 1866.*

States and Territories.	Per month, for the year, (without board.)	Per month, for the year, (with board.)	Per month, for the season, (without board.)	Per month, for the season, (with board.)	States and Territories.	Per month, for the year, (without board.)	Per month, for the year, (with board.)	Per month, for the season, (without board.)	Per month, for the season, (with board.)
Maine	$27 00	$17 44	$31 76	$23 07	Tennessee	$19 00	$12 58	$22 00	$16 61
New Hampshire	32 74	22 48	39 12	28 43	West Virginia	25 35	16 47	29 34	21 20
Vermont	32 84	21 00	37 44	25 72	Kentucky	20 23	13 65	23 80	17 06
Massachusetts	38 94	22 36	41 61	27 83	Missouri	26 75	18 08	30 84	21 66
Rhode Island	34 40	20 50	40 00	26 33	Illinois	28 54	18 72	33 09	23 30
Connecticut	34 25	21 54	39 66	28 30	Indiana	27 71	18 72	31 50	22 50
New York	29 57	19 32	34 88	24 26	Ohio	28 46	18 96	32 45	23 15
New Jersey	32 27	18 98	33 13	23 78	Michigan	31 26	20 48	34 95	24 15
Pennsylvania	29 91	18 84	34 10	22 87	Wisconsin	30 84	19 87	35 65	24 60
Delaware	24 93	13 25	26 25	15 25	Minnesota	31 65	21 10	38 40	27 17
Maryland	20 36	12 76	23 83	15 58	Iowa	28 34	18 87	33 24	23 82
Virginia	14 82	9 36	17 21	12 09	Kansas	34 03	19 81	36 40	25 46
North Carolina	13 46	8 15	15 18	10 00	Nebraska	38 37	24 64	46 42	31 36
South Carolina	12 00	7 66	14 00	9 46	Utah Territory	44 71	26 32	58 22	38 41
Georgia	15 51	9 67	18 45	12 07	Colorado Ter.	67 50	42 12	79 16	50 00
Florida	18 00	12 12	20 55	14 46	New Mexico	25 00	16 50	30 00	25 00
Alabama	13 40	9 80	16 38	11 00	California	45 71	30 35	50 00	34 39
Mississippi	16 72	11 58	22 58	16 80	Nevada	75 00	60 00	85 00	70 00
Louisiana	20 50	12 42	22 25	18 34	Washington Ter.	52 25	36 25	60 50	44 50
Texas	19 00	12 72	23 73	16 76	Dakota	30 20	20 00	32 00	22 00
Arkansas	24 21	15 80	29 61	19 46	Oregon	35 75	22 53	41 60	29 00

LOCAL VARIATION OF RATES.

The "Panhandle" of West Virginia is a notable example of high local rates of wages as compared with the State average. Its circumstances have been peculiar. Hemmed in between Ohio and Pennsylvania, and with fair facilities for getting to market, it has developed higher skill and a better style of farming than other sections of the State. The influence of slave labor in depressing rates of wages has aided in widening this difference and reducing the State average below that of the Panhandle. Sheep husbandry, which has here been successfully and very extensively conducted, (placing a sheep upon each acre of improved land,) has contributed to the high prices here prevailing. The comparison is as follows:

	Question 1.*	Question 2.	Question 3.	Question 4.
Panhandle	$31 75	$18 50	$37 00	$25 50
State of West Virginia	25 35	16 47	29 37	21 20

The rates with and without board also differ widely—$13 25 and $8 88.

Dairying.—The dairy and fruit-producing interests of northern Ohio have been of late unusually prosperous. Labor has been in demand at comparatively high rates, as will be seen from a comparison of the averages for the western reserve, the Miami valley, and the entire State:

	Question 1.	Question 2.	Question 3.	Question 4.
Western Reserve	$30 43	$20 72	$36 24	$26 22
Miami valley	28 79	18 75	32 71	23 08
State of Ohio	28 46	18 96	32 45	23 15

* Question 1. Average wages per month (without board) of farm laborers hired for the year. Question 2. Average wages per month (with board) of farm laborers hired for the year. Question 3. Average wages per month (without board) of farm laborers hired for the season or a portion of the year. Question 4. Average wages per month (with board) of farm laborers hired for the season or a portion of the year.

The difference in wages with board is not very material. The board allowance is slightly greater in the western reserve than the average for the State, and more for the "season" than for the entire year. The reverse is true of the Miami valley.

Southern Indiana.—The average rate of wages of Indiana, south of thirty-nine degrees north latitude, and the average for the whole State, are as follows:

	Question 1.	Question 2.	Question 3.	Question 4.
Southern Indiana	$26 25	$18 56	$29 24	$21 77
State of Indiana	27 71	18 72	31 50	22 50

The average differences in board allowances are respectively $7 61 and $8 99.

This average for southern Indiana, a region having in the past a reputation for comparative inferiority in agricultural improvements, indicates increasing skill in farm processes and general industrial progress, and shows a close approximation to the average of the entire State.

Southern Illinois.—Southern Illinois, too, with its rolling surface covered with forests, and less desirable soils than those of the northern prairies, has failed to secure hitherto so rapid settlement, or such an increment of improvement. Yet this region has its peculiar advantages, which have recently been seized upon by eager immigrants; and the results have been eminently satisfactory.

The following exhibit of wages is shown:

	Question 1.	Question 2.	Question 3.	Question 4.
Southern Illinois	$26 06	$16 83	$30 36	$21 41
State of Illinois	28 54	18 72	33 09	23 30

Nearness to cities.—The influence of diversification of industry and the consequent withdrawal of labor from farms to manufactures and trade, increasing the price of farm labor, as well as of farm products, is shown in the average for St. Clair county, opposite St. Louis.

	Question 1.	Question 2.	Question 3.	Question 4.
St. Clair county	$40 00	$20 00	$50 00	$35 00

Omitting from the table the vicinity of St. Louis, the showing for southern Illinois is as follows:

	Question 1.	Question 2.	Question 3.	Question 4.
Southern Illinois	$24 83	$16 62	$28 85	$20 06

Easy transportation and skilled labor.—The advantage of facilities for transportation is shown by the increased rates of wages near navigable rivers and lines of railroad. This is conspicuously seen in a comparison of the river counties of Kentucky with those of other portions of the State. Other elements of difference appear in a comparison of the river counties of the Kentucky side with those of the Ohio shore. A more diversified industry in Ohio, and the employment of free instead of slave labor, enter into the calculation and make a material advance in the rate. The following table exhibits nearly as great a difference between the river counties of Ohio and those of Kentucky as exists between the latter and those of the entire State:

	Question 1.	Question 2.	Question 3.	Question 4.
State of Kentucky	$20 23	$13 65	$23 80	$17 06
River counties, Kentucky	24 23	16 36	28 79	20 36
River counties, Ohio	28 27	17 36	32 81	22 33

Free labor influence.—The influence of changing the system of labor in a State from slave to free is illustrated very conspicuously in the belt of States from Virginia to Missouri. Virginia has been divided for several years, and that portion west of the mountains, formerly in comparative discredit as an agricultural region, shows a much higher rate of wages than Virginia proper. Slave labor, for several years, has scarcely been known in a large portion of Missouri. The following is a showing of the rate of wages for these States:

	Question 1.	Question 2.	Question 3.	Question 4.
Virginia	$14 82	$9 36	$17 21	$12 09
West Virginia	25 35	16 47	29 34	21 20
Kentucky	20 23	13 65	23 80	17 06
Missouri	26 75	18 08	30 84	21 56

BOARD OF FARM LABORERS.

The difference between wages without board and the rate allowed when board is furnished by the employer is naturally found to vary quite regularly with the cost of food products, the rate being higher in the east than in the west, and higher still in the Territories of the Rocky mountains, but less in California than in Massachusetts. In the south the board of freedmen, consisting mainly of corn meal and bacon, is, of course, very low. Possibly in Alabama the difference between labor with and without board may be too small. The mode of hiring and supplying these laborers varies so much with circumstances that our correspondents found it difficult to reduce their information to the system required. The following is a statement of these differences in monthly pay on account of board, averaging $6 26 in the southern States, and $12 51 for the other States:

Maine	$9 56	Tennessee	$6 42
New Hampshire	10 76	West Virginia	8 88
Vermont	11 84	Kentucky	6 58
Massachusetts	16 58	Missouri	8 67
Rhode Island	13 90	Illinois	9 82
Connecticut	12 71	Indiana	8 99
New York	10 25	Ohio	9 50
New Jersey	13 29	Michigan	10 78
Pennsylvania	11 07	Wisconsin	10 97
Delaware	11 68	Minnesota	10 55
Maryland	7 60	Iowa	9 47
Virginia	5 46	Kansas	11 22
North Carolina	5 31	Nebraska	13 73
South Carolina	4 34	Utah Territory	18 39
Georgia	5 84	Colorado Territory	25 38
Florida	5 88	New Mexico Territory	8 50
Alabama	3 60	California	15 36
Mississippi	5 14	Nevada	15 00
Louisiana	8 08	Washington Territory	20 00
Texas	6 28	Dakota Territory	10 20
Arkansas	8 41	Oregon	13 22

The average, as above, for white laborers, is $12 51 per month; in the south, with reference mainly to freedmen, $6 26.

M.—*Showing the rate of wages of agricultural labor, per day, in transient service, from returns from statistical correspondents, county clerks, and county auditors, made in December,* 1866.

States	Per day, for transient service in harvest, (without board.)	Per day, for transient service in harvest, (with board.)	Per day, for transient service other than in harvest, (without board.)	Per day, for transient service other than in harvest, (with board.)
Maine	$2 02	$1 56	$1 49	$1 13
New Hampshire	1 98	1 52	1 67	1 26
Vermont	2 32	1 65	1 76	1 33
Massachusetts	2 41	1 92	1 83	1 38
Rhode Island	2 23	1 71	1 83	1 33
Connecticut	2 43	1 90	1 75	1 29
New York	2 41	1 92	1 75	1 23
New Jersey	2 68	2 38	1 68	1 20
Pennsylvania	2 32	1 80	1 59	1 10
Delaware	2 09	1 62	1 31	94
Maryland	2 00	1 68	1 31	96
Virginia	1 46	1 21	82	57
North Carolina	1 53	1 17	72	50
South Carolina	1 25	93	69	45
Georgia	1 48	1 06	99	70
Florida	1 12	83	1 00	74
Alabama	1 27	1 04	78	55
Mississippi	1 65	1 14	1 34	89
Louisiana	1 66	1 20	1 08	70
Texas	1 65	1 32	1 31	98
Arkansas	2 07	1 52	1 34	88
Tennessee	2 01	1 54	1 15	83
West Virginia	1 78	1 31	1 31	92
Kentucky	2 10	1 70	1 21	86
Missouri	2 15	1 72	1 44	1 07
Illinois	2 41	1 91	1 62	1 21
Indiana	2 23	1 76	1 45	1 06
Ohio	2 20	1 73	1 54	1 13
Michigan	2 62	2 14	1 78	1 30
Wisconsin	2 68	2 15	1 78	1 28
Minnesota	2 68	2 27	1 75	1 35
Iowa	2 38	1 88	1 62	1 19
Kansas	2 31	1 82	1 65	1 19
Nebraska	2 65	2 15	1 93	1 43
Utah Territory	3 42	2 49	2 27	1 63
Colorado Territory	4 17	2 87	3 29	1 93
New Mexico Territory	1 50	1 12	1 00	90
California	2 56	2 06	2 26	1 72
Nevada	3 50	3 00	3 00	2 50
Washington Territory	3 00	2 25	2 25	1 75
Dakota Territory	2 50	2 00	2 00	1 50
Oregon	2 40	1 80	1 75	1 40

N.—*Showing the average prices of harvesting and stacking wheat and cutting and stacking hay.*

States.	Price per acre of harvesting and stacking wheat, including all the labor of men and horses.	Price per acre of cutting, curing, and stacking hay.	Price per acre of cutting hay only.
Maine	$4 37	$3 54	$1 16
New Hampshire	5 75	3 77	1 33
Vermont	4 33	3 48	1 19
Massachusetts	4 72	5 19	1 75
Rhode Island	6 00	6 12	1 71
Connecticut	3 70	4 75	1 81
New York	3 88	3 28	1 11
New Jersey	4 36	4 04	1 52
Pennsylvania	4 36	4 10	1 38
Delaware	3 25	3 87	1 50
Maryland	4 21	4 83	1 57
Virginia	2 07	1 98	1 05
North Carolina	1 84	2 67	1 59
South Carolina	1 56	3 37	1 50
Georgia	2 41	2 82	1 81
Florida	......	......	......
Alabama	2 17	3 66	1 75
Mississippi	2 66	3 31	1 50
Louisiana	......	......	......
Texas	2 65	4 06	1 70
Arkansas	3 00	4 37	1 96
Tennessee	2 36	3 49	1 86
West Virginia	2 75	2 74	1 07
Kentucky	3 03	3 51	1 60
Missouri	3 59	3 25	1 12
Illinois	3 32	2 69	90
Indiana	3 33	3 09	1 07
Ohio	3 18	3 10	1 00
Michigan	3 41	3 14	1 09
Wisconsin	3 28	2 73	1 05
Minnesota	3 33	3 34	1 26
Iowa	2 95	2 58	81
Kansas	3 73	3 90	1 03
Nebraska	4 28	3 53	98
Utah Territory	9 32	8 91	3 37
Colorado Territory	9 56	7 79	3 85
New Mexico Territory	6 50	......	......
California	2 76	3 00	1 25
Nevada	......	8 00	3 00
Washington Territory	3 00	5 50	2 00
Dakota Territory	2 50	4 00	1 50
Oregon	3 75	3 00	94

The following questions were fully answered, but, owing to the great diversity in the mode and conditions of such operations, no average could fairly be drawn:

"10. Price, per bushel, of threshing and separating wheat?

"11. Price, per bushel, of threshing and separating oats?

"12. Price, per bushel, of husking and cribbing corn?

"13. Price, per bushel, of shelling corn?

"14. Price, per acre, of cutting and stacking hay?"

In some localities the machine and its manager only are furnished, at a low price per bushel; in others, additional men or horses; in others, still, all labor, board, or other expense. The prices, therefore, vary, as in Illinois, for instance,

from three to seventeen cents per bushel. And so in other States. The actual returns from Illinois would average $8\frac{1}{5}$ cents; question 11th, average $5\frac{1}{10}$ cents. In cutting and stacking hay, in Illinois, the returns ranged from $1 50 to $4 per acre, representing not so much a difference in the price of labor as in what was locally understood by "cutting and stacking hay." So of other machine operations.

COMPARISON WITH EUROPEAN LABOR.

The rates of labor in Europe are much less than in this country. Elaborate calculations by Professor Leone Levi make the total earnings of the laboring classes of Great Britain $2,091,500,000 in all industries; in agriculture, $375,000,000. The average income of a working man in England is $5 62 per week; in Scotland, $5 12; and in Ireland, $3 58.

The agricultural laborer receives scarcely two-thirds as much as the general average. Mr. Levi does not give the average rate, but it can be readily approximated. In England $1 75 to $2 per week may be considered the lowest rate, while few farm laborers obtain more than $4 or $4 50. The former rate, with the bonus of "a little cider," is common in Devonshire; in South Shropshire, $2 75, with additions equal to seventy-five cents more, or $3 50 in all; in Dorsetshire, $2; in Durham and Northumberland, $3 75, with house and garden, coal, potatoes, and wheat. It may not be very wide of the truth to estimate the present wages of the English farm laborer at $3 50 per week. Allowing four weeks for holidays and absence from other causes, the year's earnings would be $168. Wade's History of the Middle and Working Classes placed the average of husbandry wages at $3, which was believed to be high at that time. Mr. Senior made the average of all kinds of labor $168 per year in Britain, and $224 in the United States. Farm labor then averaged less. This is not given as the actual average, but is probably quite as favorable to the laborer as it can truthfully be made.

The American farm laborer, as has been shown, gets $28 per month, or, counting eleven months' work each year, $308 per annum. Although the pay is in currency, each dollar will buy more breadstuffs and vegetables in the great western agricultural sections than will a gold dollar in England.

Wages have materially increased of late. Mr. Levi estimates that one-half the laborers of the United Kingdom, from increase of wages, are able to consume one pound more meat each per week than formerly.

Our farm labor proper (meaning *hired* farm labor) is a small item compared with the labor of farmers and their sons. There are about 900,000 farm laborers, exclusive of the freedmen, and 2,500,000 farm proprietors, yet the labor of these 900,000 is no insignificant item. At $308 each per annum it amounts to an aggregate of $277,200,000, $2,200,000 more than Mr. Levi's estimate of agricultural labor in Great Britain. And this is but little more than one-fourth of the actual farm labor done by white laborers. The freedmen, of whom a large portion of the adults, male and female, are farm laborers, will swell the total estimate of agricultural labor to a magnificent figure.

It is believed that such an exhibition of the facts of this great department of human industry will furnish profitable food for reflection and information tending to promote the profits of industry and the welfare of the human race.

The people of Europe, through millions of friends already reaping the fruits of well-remunerated labor here, are now pouring in upon us in larger numbers than ever before; yet there is room enough for all, and prospective plenty and wealth, after meeting the demands of the government, which will decrease in gravity year by year.

IMPORTS OF WOOLS AND WOOLLENS.

The country has been flooded with imported unmanufactured wools and woollen goods since July 1, 1865, in anticipation of an increase in the duties, which was so long deferred that a ruinous displacement of domestic wools was the result. The extent of this derangement will be apparent by an exhibition of official figures of wool imports. It will be remembered that the four years of war were necessarily years of excessive importation, amounting to nearly two hundred and fifty-two millions of pounds of wool and twenty-seven millions of shoddy, and that during the last year of that period, 1865, ending three months after the close of the war and six months after such result seemed inevitable, the importation was reduced to forty millions of dutiable wool, and a little more than three millions of free wool from Canada. The reduction should have continued, as we now produce about one hundred and fifteen millions, and can add twenty millions in a single year if the business promises to pay. Instead of such reduction, an enormous increase was made, not only through the fiscal year of 1865–'66, but from July to March, 1867, when the wool tariff went into effect, as follows:

Years.	Dutiable.	Free.	Total.
	Pounds.	*Pounds.*	*Pounds.*
1865	40,372,075	3,486,079	45,858,154
1866	67,917,031	1,206,234	69,123,265
Excess over 1865			23,265,111

Including the shoddy, the increase was nearly twenty-six millions. The imports of the year ending June 30, 1867, were 35,325,151 pounds, costing $5,770,083; shoddy, 5,086,187 pounds, costing $516,480. A glut in the wool market was the result, though prices did not decline, because the wool was largely held in bond in expectation of a decrease of future importation by high duties. This was sufficient to prevent a material increase of the low current prices, compelling farmers to await patiently the consumption of these foreign supplies. Nor was this all; manufacturers, as well as farmers, were to suffer by an equally excessive importation of woollens—in fact, an unprecedented influx, *almost equaling in a single year the imports of woollens for the entire period of the war*, as the following totals will show:

Total for four years ending June 30, 1865	$87,762,918
Annual average for four years ending June 30, 1865	21,940,729
Imports of the year ending June 30, 1866	57,115,901

This is a sum equal to the present total valuation of the annual wool clip of the United States. The expectation of obtaining a fair price for wool will be futile until this immense stock of goods is worked off, the old army supplies exhausted, and a normal condition of supply and demand is regained.

The following tables give the details of these importations of the year ending June 30, 1866:

O.—*Statement exhibiting the quantity and value of wool imported into the United States during the year ending June* 30, 1866.

Countries.	Wool on the skins or wool skins.	Wool: Value 12 cents per pound or less.		Wool: Value over 12 and not over 24 cents per pound.		Wool: Value over 24 and not over 32 cents per pound.		Wool: Value over 32 cents per pound.		Woollen flocks, waste or shoddy.	
	20 per cent.	3 cents per pound.		6 cents per pound.		10 cents per pound and 10 per cent.		12 cents per pound and 10 per cent.		3 cents per pound.	
	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.	Pounds.	Dollars.
Russia on the Black sea		519, 513	57, 665	1, 088, 186	218, 144						
Danish West Indies	164	200	12								
Hamburg	2, 638	291, 860	35, 712	33, 694	5, 813					2, 305, 197	180, 041
Bremen				160	36					379, 283	36, 087
Holland				133, 101	21, 835					75, 002	4, 418
Dutch West Indies		18, 241	1, 878	1, 105	137						
Belgium				1, 923, 495	324, 204					530, 361	36, 600
England	24, 087	1, 513, 193	162, 342	6, 697, 129	1, 244, 886			330, 873	150, 929	3, 755, 408	313, 697
Canada	1, 544			20	5	3, 959	1, 261	42	15	2, 624	286
Other Brit. Amer. Poss. on the Atlantic	876	6, 494	393			502	81				
British American Poss. on the Pacific		2, 695	370								
British West Indies	180	476	59	1, 664	289					1, 322	137
British Possessions in Africa	26, 593	23, 706	2, 483	7, 400, 511	1, 197, 488						
British East Indies		850, 030	90, 362	1, 265, 802	124, 159						
Australia		23, 035	2, 618	850, 775	171, 990	309	56				
France on the Atlantic	825			371, 630	65, 363					80, 059	17, 376
France on the Mediterranean		3, 201	338	160, 558	21, 593					15, 844	636
French Possessions in Africa		223	28								
Cuba		3, 000	300								
Italy										2, 006	212
Turkey in Europe		3, 981	253								
Turkey in Asia		956, 101	102, 224	317, 474	58, 209						
Hayti				56, 884	10, 263						
Mexico	185	136, 993	13, 617	22, 545	3, 865	3, 759	1, 000				
New Granada		8, 510	807	100	21			50	31		
Brazil	567	978, 059	99, 536	477, 533	74, 225						
Uruguay		264, 419	27, 099	1, 960, 210	293, 947						
Buenos Ayres, or Argentine republic	40, 050	24, 626, 555	2, 713, 559	12, 289, 239	1, 843, 907						
Chili		2, 130, 415	210, 233	147, 331	23, 118						
Sandwich Islands		5, 235	529	12, 256	1, 796						
Whale fisheries	12										
Total	97, 960	32, 366, 135	3, 522, 417	35, 211, 402	5, 705, 293	8, 529	2, 398	330, 965	150, 975	7, 147, 108	589, 490

P.—*Giving a statement of woollens imported during the year ending June 30, 1866.*

Woollen cloths and shawls	$16, 615, 276
Blankets	527, 540
Woollen worsted yarns	556, 939
Delaines and dress goods	21, 111, 284
Carpets	2, 854, 097
Flannels	138, 313
Felt and lasting	146, 286
All others	15, 166, 166
Total	57, 115, 901

Q.—*Showing the prices of various wools on February 22, prior to the passage of the tariff act, and at two subsequent dates.*

Grades of wool.	February 22.	April 26.	July 12.
	Per pound.	*Per pound.*	*Per pound.*
American, Saxony fleece	50 to 65	62½ to 75	70 to 75
American, full-blood Merino	48 to 60	58 to 61	60 to 65
American, half and three-quarters Merino	45 to 50	53 to 57	55 to 60
Extra, pulled	50 to 55	50 to 55	55 to 60
Superfine, pulled	40 to 50	40 to 50	45 to 60
No. 1, pulled	30 to 40	30 to 40	25 to 30
California, unwashed	30 to 40	30 to 40	30 to 45
California, common	22 to 23	22 to 27	20 to 25
Texas	18 to 32	18 to 33	25 to 30
Peruvian, unwashed	33 to 33	30 to 33	
Valparaiso, unwashed	28 to 30	28 to 30	25 to 28
South American Mestiza, unwashed	32 to 34	32 to 34	28 to 33
South American, common, unwashed	25 to 27	25 to 27	24 to 26
South American Cordova	40 to 46	40 to 46	40 to 46
Entre Rios, washed	32 to 48	32 to 38	40 to 46
African, unwashed	20 to 30	20 to 30	
African, washed	30 to 40	30 to 40	
Mexican, unwashed	20 to 27	20 to 27	22 to 27
Smyrna, unwashed	28 to 32	28 to 32	18 to 21
Smyrna, washed	35 to 58	35 to 58	40 to 42

Table showing the value of woollens imported, and the quantity and value of wool imports, for the period from 1841 *to* 1866, *inclusive.*

Year.	Woollens.	Wool.	
		Pounds.	
1841	$11,001,939	15,006,410	$1,091,953
1842	8,375,725	11,420,958	779,482
1843	2,472,154	3,517,100	245,000
1844	9,475,702	14,008,000	851,460
1845	10,666,176	23,833,040	1,689,794
1846	9,935,925	16,558,247	1,134,226
1847	10,998,933	8,460,109	555,622
1848	15,240,833	11,341,429	857,034
1849	13,704,606	17,869,022	1,177,347
1850	17,151,509	18,669,794	1,681,691
1851	19,507,309	32,548,461	3,833,157
1852	17,573,964	18,341,298	1,930,711
1853	27,621,911	21,599,079	2,669,718
1854	32,382,594	20,200,110	2,822,185
1855	24,404,149	18,534,415	2,072,139
1856	31,981,793	14,737,393	1,665,064
1857	31,286,118	16,502,060	2,125,744
1858	26,486,091	*95,000,000	4,022,635
1859	33,521,956		4,444,954
1860	37,936,945		4,842,152
1861	28,261,039	36,000,000	4,961,326
1862	14,884,394	43,571,026	6,994,606
1863	20,411,625	73,897,807	12,553,931
1864	32,139,336	90,396,104	15,923,991
1865	20,347,563	43,858,154	7,728,383
1866	57,115,901	67,917,031	9,381,083

The aggregate importation of woollens for each decade, and the average per year for forty years, ending in 1860, are as follows:

	Aggregate.	Annual average.
Ten years ending in 1830	$86,182,110	$8,618,211
Ten years ending in 1840	129,336,258	12,933,625
Ten years ending in 1850	109,023,552	10,902,355
Ten years ending in 1860	282,682,830	28,268,283
Forty years ending in 1860	627,224,750	15,680,618

In 1820, when this importation commenced, manufacturing was at its lowest ebb, the value of its annual product having been reduced to $4,413,068, by excessive importations after the close of the war of 1812, from $25,608,788 in 1810, just as foreign traders, aided by American importers, at the close of the late war, and the fall of gold, have seriously impaired both the wool growing and wool manufacturing interests by flooding the country with a vast surplus of foreign woollens. While suffering a series of fluctuations, caused by more or less successful efforts to break down the barriers to over-importation, the progress of manufacturing has been gradual and comparatively regular. In 1830 the product of woollen manufactures had increased to $14,528,166; in 1840 it was $20,696,999; in 1850, $43,207,545; in 1860, $68,865,963; in 1864 a return of manufacturers, representing about three-fourths of the total number of sets of machinery, made an aggregate of $120,000,000.

* Estimated.

With the increase of the manufacture of wool, step by step, advanced the production of wool. The census of 1850 made the clip of that year 52,516,959 pounds; that of 1860 returned 60,511,343. The yield of 1864 was estimated at 95,000,000; that of 1866, 115,000,000. The increase of manufacturing and the relative consumption of wool at different periods may be gathered from the following statement, with the qualification that the wool importation of 1865 was less than the consumption of foreign wool for that year, while that of 1866 was far more than that year's consumption. There was also, in round numbers, four millions of pounds of shoddy in the former, and seven millions in the latter year, not counted in the statement:

	1840.	1850.	1860.	1865.	1866.
United States products ...lbs..	35,802,114	52,516,969	60,511,343	105,000,000	115,000,000
Imports.................lbs..	15,006,410	18,669,794	34,586,657	40,372,075	67,917,031
Total.................	50,808,524	71,186,763	95,098,000	145,372,075	182,917,031

It is not that woollen importations are so much heavier than formerly, in proportion to population. As shown above, the average for forty years, when we manufactured comparatively little, was $15,680,618. With population doubled and foreign prices at least fifty per cent. greater than twenty-five years ago, $45,000,000 would not be a larger proportionate importation. Then we manufactured scarcely half the annual consumption; now we manufacture three-fourths, and of most goods can easily manufacture for the entire demand, so that *any* importation tends to drug the market. This is the literal fact, and the future will show how sensitive a full market is to the slightest surplus—just as a few drops will overflow a brimming glass. All the woollens imported in four years of war amounted to but $87,782,918, or $21,945,726 annually; actually a less quantity of goods than was bought for $15,680,618 annually for forty years, commencing in 1821; but in the mean time the products of our mills had grown from four millions of dollars in 1820, to one hundred and fifty or sixty millions in 1864!

AGRICULTURAL EXPORTS.

Statement of the exports of the growth and agricultural products of the United States, with their immediate manufactures, for the years ending June 30, 1865, *and June* 30, 1866.

Products and manufactures.	1865.		1866.	
	Quantity.	Value.	Quantity.	Value.
Of animals:				
Hogs.............number—	1,400	$12,771	951	$15,454
Pork..............tierces..	838	6,843,135	30,056,788	4,788,484
Do..............barrels..	207,294			
Hams and bacon....pounds..	45,990,712	10,521,702	37,588,930	6,269,796
Lard..................do....	44,342,295	9,107,435	30,110,451	5,970,651
Lard oil............gallons..	99,250	155,454	42,358	70,[illegible]60
Horned cattle......number..	9,588	159,179	7,730	323,637
Beef ....tierces..	50,392	3,304,771	19,053,800	2,766,451
Do ....barrels..	59,822			
Tallow............ pounds..	30,622,865	4,979,135	19,364,686	2,488,587
Hides............ number..	205,950	1,023,596	349,897	108,752

Statement of exports—Continued.

Products and manufactures.	1865.		1866.	
	Quantity.	Value.	Quantity.	Value.
Of animals:				
Butter .... pounds..	21,388,185	7,234,173	3,806,835	1,267,851
Cheese .... do....	53,089,468	11,684,927	36,411,965	6,036,828
Candles .... do....	5,017,712	1,259,168	3,191,800	616,496
Soap .... do....	7,327,834	983,477	....	784,492
Horses .... number..	690	110,270	1,423	243,698
Mules .... do....	350	52,115	1,810	218,271
Fine leather and morocco, skins..	....	150,828	....	16,760
Leather .... pounds..	1,287,407	517,717	....	426,762
Boots and shoes ...... pairs..	522,308	2,023,210	214,567	590,307
Sheep .... number..	13,782	72,198	12,478	87,214
Wool .... pounds..	466,182	254,721	....	403,860
Skins and furs	....	1,648,863	....	1,351,092
Wax .... pounds..	338,776	261,381	272,987	130,650
Apples .... barrels..	120,063	479,256	....	301,383
Potatoes .... bushels..	510,344	724,593	470,753	535,446
Onions	....	220,694	152,437	162,410
Breadstuffs:				
Indian corn .... bushels..	2,812,726	3,679,133	13,516,651	11,070,395
Indian meal .... barrels..	199,419	1,489,886	237,275	1,129,484
Wheat .... bushels..	9,937,152	19,397,197	5,579,103	7,842,749
Flour .... barrels..	2,604,542	27,222,031	2,183,050	18,396,686
Rye meal .... do....	3,935	32,438	13,304	68,144
Rye and small grains. bushels.	691,152	846,444	....	1,336,282
Rice .... barrels..	2,395	63,430	....	136,993
Biscuit or ship bread	....	771,952	10,091,988	701,603
Cables and cordage ...... cwt..	52,419	972,348	8,570	173,852
Cotton, Sea-island .... pounds..	330,584	296,179	7,284,473	6,424,770
Cotton, other kinds ...... do....	6,276,582	5,424,370	643,288,356	274,960,453
Cotton piece goods:				
Printed or colored	1,080,521	618,223	405,998	88,742
White, other than duck	100,265	44,742	3,041,715	718,006
Duck	77,618	101,796	....	....
All other man'fact'r's of cotton.	....	2,566,821	....	973,427
Clover-seed .... bushels..	2,169,426	446,845	144,742	772,607
Flax-seed .... do....	39,369	120,091	87	306
Linseed oil .... gallons..	64,913	110,156	18,750	28,351
Oil-cake	36,512	2,267,393	107,840,690	2,775,426
Hemp .... tons..	2,111	259,393	2,260	27,161
Hemp, all manufactures of	....	119,738	....	413,303
Ginseng .... pounds..	414,507	547,653	444,398	382,870
Hops .... do....	3,662,734	1,348,263	349,987	108,752
Spirits of turpentine ... gallons..	42,518	95,747	349,325	313,086
Salt .... bushels..	582,803	$355,469	670,644	$300,980
Beer, ale, porter, and cider	....	163,151	....	65,445
Spirits from molasses .. gallons..	1,149,859	708,134	1,793,334	605,163
Spirits from other material. do...	218,551	394,770	309,549	149,335
Molasses .... do...	28,221	16,308	55,653	21,102
Vinegar .... do...	136,414	46,100	114,800	37,686
Sugar, brown .... pounds..	116,240	20,617	469,661	63,124
Sugar, refined .... do...	1,309,522	284,906	3,996,477	652,543
Tobacco	....	41,592,138	190,826,248	29,456,145
Tobacco, manufactured	7,297,878	3,580,245	....	1,914,235
Snuff .... pounds..	93,159	39,129	18,920	7,981
Wood and its products:				
Staves and heading. thousand.	33,029	2,911,310	24,490	2,267,616
Shingles .... do....	33,034	173,760	25,480	108,248
Boards, plank and scantling, M feet..	158,774	4,340,664	120,013	2,882,572
Hewn timber .... tons..	4,133	69,699	19,975	368,078

Statement of exports—Continued.

Products and manufactures.	1865.		1866.	
	Quantity.	Value.	Quantity.	Value.
Wood and its products:				
Other lumber	....	3,422,719	....	1,439,346
Oak bark and other dyewood	....	158,495	....	....
Other manufactures of wood	....	1,254,888	....	5,178,923
Ashes, pot and pearl......cwt..	52,677	727,229	3,078,757	298,139
Tar and pitch..........barrels..	11,529	76,034	37,835	147,528
Rosin and turpentine....do....	11,232	157,662	250,407	1,504,058

A recapitulation of exports of the growth and agricultural products of the United States, and their immediate manufactures, for the years ending June 30, 1865, *and June* 30, 1866.

	1865.	1866.
Animal productions	$62,361,126	$34,976,453
Breadstuffs	53,502,511	40,682,336
Wood and its products	13,292,460	14,194,513
Cotton and its manufactures	9,052,131	283,165,398
Miscellaneous	54,913,137	39,265,692
Total	193,121,365	412,284,392

RECEIPTS AT THE NEW YORK CATTLE MARKET IN 1866.

Number of beeves	298,882
Number of milch cows	4,885
Number of veal calves	62,114
Number of sheep and lambs	1,030,621
Number of swine	666,392
Total	2,062,894

These figures are given on the authority of the Tribune report of the cattle market; they show a weekly average of 5,748 beeves, 94 cows, 1,194 calves, 19,820 sheep, 12,815 hogs, a total of 39,671 animals per week. The total for the year is 301,539, greater than that of the previous year, which, in turn, was larger than those of any of the eleven previous years, except 1862 and 1864.

The average price of beef (net weight, sinking the offal) for the year was 15⅛ cents per pound. In January the different qualities ranged from 12 to 22 cents; in December, from 9 to 21 cents. The prices of sheep and swine are for the live weight. Sheep commanded from 6 to 8 cents in the beginning of the year; at the close, 5 to 6½ cents. The price of swine ranged from 6 to 13 cents.

For the statistics of California, an essay upon the agriculture of that State is referred to in another part of this volume. Interesting, though desultory, statistics of the Territories have been collected, but their arrangement and enlargement must be deferred for the present.

J. R. DODGE.

Hon. ISAAC NEWTON, *Commissioner.*

REMARKS ON PRUNING AND TRAINING THE GRAPE-VINE, WITH QUOTATIONS AND ILLUSTRATIONS FROM VARIOUS AUTHORS.

BY WILLIAM SAUNDERS, DEPARTMENT OF AGRICULTURE.

THE increasing interest manifested in the culture of the grape induces a corresponding desire for information with regard to details of the various operations connected with it. Especially is this true with reference to everything bearing upon the pruning and training of the plant; for although its natural habit of growth will speedily indicate, to a close observer, the best mode of management, yet there are so many systems advocated and eagerly pressed upon the consideration of those who are anxiously seeking knowledge upon these subjects, that it is difficult for them to decide among so many seemingly conflicting opinions.

There is one well authenticated fact in the fruiting of the grape, viz., that the finest fruit, the best, earliest, and largest crops, are produced upon the strongest shoots of the previous year's growth. The only proper system of pruning will therefore be that which encourages and secures an abundance of such shoots, and to show that this principle has been constantly recognized for nearly two hundred years, we have prepared and arranged the following quotations from various authors, with the different modes of practice deduced from it; and we do so with the hope of impressing as fully as possible upon the minds of beginners in grape culture the necessity of proving all new systems, so called, by this general principle, so that they may be able to guard against receiving false impressions with reference to any mode that may fall under their observation.

There are certain fundamental principles, unchangeable in their nature, governing the growth of plants, and all manipulations and operative practices which are recognized under the general term *cultivation* must be in accordance with, rather than in opposition to, these natural laws. There is abundant evidence that the true nature of the vital action of plants, and of the external forces by which they are regulated, is but indifferently understood by the majority of writers on pomology; hence the necessity of caution in adopting many of the methods of culture, some of which are based simply upon the fancy of the writer, who hesitates not to enforce his ideas with plausible descriptions, if, indeed, they are not paraded with all the "pomp and circumstance" of conclusive and exhaustive experiment.

It cannot have escaped the observation of those whose attention has been directed for a series of years to the culture of the grape, that the best fruit is produced from terminal shoots; also that even under what might be termed indifferent treatment, young vines will bear good crops for a few years; further, that under any mode of pruning that involves the retention of wood beyond five or six years, as in the case of spur-pruning, the results are weak, imperfectly ripened shoots and bunches. Under this head we also place all those methods where fruiting shoots are produced from permanent horizontal branches, as in the Thomery system. In all such limited modes of training it is absolutely essential to remove the older wood at certain periods, and replace it with young wood from near the base of the plant.

If it were convenient to allow a vine to extend its cane yearly in one direction it might be retained for any number of years, and still produce good fruiting

wood at its extremities. Reference is frequently made to the great age of the Hampton Court vine, in England, to disprove the necessity of cutting down. But that vine is also cut down—that is, a periodical removal of old wood is practiced. Twenty years ago the main stem of that famous plant extended to a length of one hundred and eighteen feet before furnishing bearing wood. In ordinary vineyards such a mode of training would, to say the least, be very inconvenient; neither is it by any means necessary.

In looking over some old works on horticulture I have been interested in observing that a few only seem to have studied for themselves; many, as is still the case, merely copy from those who have written before them, frequently using the same language, taking special care not to credit their authority. These mere copyists are of course passed over in these quotations. We commence with the following:

"THE COMPLEAT ENGLISH GARDNER.—BY LEONARD MEAGER: LONDON, 1682."

After giving concise directions about preparing the soil and planting the vine in spring, the author treats upon the yearly management of the plants: "Begin not to prune your new set vineyard before the January after, and then cut off all the shoots as near as you can, sparing only the strongest and most vigorous to each, which you must leave with two eyes of young wood, and then let them rest till May, the second year after planting; and then be sure to clean the roots of all collateral suckers, which only rob or exhaust your sets; and leave none but what break out of these two or three eyes of the young wood before mentioned. And thus you should govern your vineyard the third year, cutting off very close all the shoots in the same month, January, and only sparing the stoutest which is next the ground, yet so that you leave him not above three or four eyes.

"In this third year perhaps you may enjoy some fruit of your labor, which, if agreeable to your hopes, will require props, which are usually made of hazel, ash, oak, and in length about four foot, and as thick as a broom-stick; which being rightly placed on the north side of your plant, in May you must (the thieves which spring from the root of the plant must be rubbed off, and only leave such as come from the stem, or such as may bear fruit) bind up the shoots of those three eyes which were ordered to be left as being likely to be bearers that year, which in June you may discover when the fruit is about the size of small shot; break off the branches at the second joint above the fruit, and the rest tye the prop.

"The first year after your vines have borne fruit you will have to every plant three or four shoots; therefore in January or December be sure prune all away but the strongest, which you must leave for standards, which must be about four or five foot in height, cutting the rest away very close to the body of the mother plant, (that is, such as appear useless shoots,) but mind you secure such as are about the bigness of a large reed, to which leave two or three eyes next the ground; then set a prop to every one of your vines, and to them tye the master shoots, which you were ordered to leave four foot high, with some tender oziers about one foot from the ground, bending the top of these shoots to the next prop from the ground about two foot, so that your ranks may stand in the likeness of arches, whilst the eyes that you spared in dressing shall be bound to the props the May following, for the next year's bearing, to the great increase of your grapes. Then in May, or beginning of June, (when the small raisens are of the bigness before mentioned,) stop the second joint above the fruit as you were before taught, but be mindful to leave the strongest shoot to be the standard plant of the year following. In August the fruit will begin to turn ripe; break off such shoots as you may find too thick upon those you prune in May, but do this with discretion and only so as to let in the sun to ripen the clusters overshadowed, which leave screened with some of the leaves, to preserve them both from the scorching of the sun by day and the dews by night, both of which are hurtful.

"Observe now that the standards you last tied to the props at a foot high, and

whose tops were bent to the next, will be grown old wood the year ensuing; therefore in the first pruning season, or January after, remember you cut them close to the ground, supplying their places with the strongest shoots of your young wood, which for the purpose you left four foot high, and which you must order as you have been instructed the year before, pruning the rest to the very earth, and leaving to each of the strongest shoots two eyes, as is before mentioned."

The method here minutely, although somewhat diffusely described, is exactly the same as the renewal *bow* system still practiced in some of our vineyards, and recognizes the true principle of *ordering* the grape-vine.

"THE CLERGYMAN'S RECREATION, SHOWING THE PLEASURE AND PROFIT OF THE ART OF GARDENING.—BY THE REV. JOHN LAWRENCE: LONDON, 1717."

Under the head of general pruning this author observes: "That the more the branches of any tree are carried horizontally, the more apt and the better disposed that tree is to bear fruit; and consequently, the more upright and perpendicular the branches are led, the more disposed that tree is to increase in wood and less in fruit."

The greater portion of this work is arranged in the form of monthly calendars. In the calendar for November we read as follows:

"But of all other works, that which I reserve to be performed in this month is the pruning of vines for the winter, which yet is to be done with great judgment and discretion, if fair and good fruit is to be expected. In the performance of which work, therefore, be sure leave but few, and those the thickest and ablest, of the last year's branches, taking the small entirely away from the place where they shot. But then the chiefest art in this work is so to order the matter that no part of the trellis be left naked or unfurnished of bearing wood. For which purpose every year some of the old wood must be cut down to the ground, with a view of having young wood to bear fruit the succeeding year at the bottom, laying such branches as horizontally as may be. To accelerate also the ripening of such fruit near the ground, it is very proper to pave the borders with coarse broad slabs or slats.

"The very ablest branches of all (of this last year's wood I speak) are to be pruned to about two foot long, and the rest to about three, or four, or five buds, still observing to leave one shorter between two longer, by which means an ingenious operator may order the matter so as that the fruit may lie at right distances in all parts of the trellis pretty equally.

"But have a care of leaving too many of even the larger branches; near a foot asunder is, generally speaking, enough. The vine is so quick a grower, and makes such luxuriant shoots that it insensibly steals away, as it were, and leads you into one great error, of leaving the bottom of the trellis naked and unfurnished; therefore I cannot but add here, and repeat it, that it is advisable at every winter pruning to cut away here and there a stem of the old wood close to the ground, from whence may assuredly be expected bearing wood for the following year near the ground, provided only two or three buds of such shoots be left.

"With regard to summer pruning and management, it is recommended in April to watch new planted vines, and not suffer above one shoot, or two at most, to remain; for the first, and indeed the only, thing, you are to aim at is to get large and consequently bearing wood as soon as may be, which yet is not otherwise to be done but by taking away all the smallest shoots. As far as I have observed, there is a general failure in this point; and therefore I am willing to add, that if all or most of the weak shoots be suffered to grow on a young vine every year successively, you may wait six, or seven, or eight years without fruit, and then only at last see starved little bunches of grapes; whereas if the head of the young vine be carefully disburthened as aforesaid, the root is of consequence strengthened to push the bolder, and to reward the careful pruner with fair fruit, if not the second, yet the third year at furthest."

The subject of summer pruning is continued in the calendar for July: "It ought to be carefully taken notice of that from the vigorous shoot of a vine already once pruned, there will push again several midsummer shoots, weaker than the former, from the first, second, and third bud toward the extremity, which secondary shoots are to be taken off, only remembering that it is proper so far to spare the last of such secondary shoots as to leave one bud upon it, from whence nature may exert itself a third time in autumn. The reason of which practice is this, that if these secondary shoots were all entirely removed the vine would push at those bearing buds which lie at the bottom of the aforesaid shoots, the effect whereof would be either the want of fruit at those places next year, or a necessity of pruning the branch shorter than was intended or is convenient in the winter.

"Extraordinary good soils and climate, or artificial heats, may do wonders; but I advise my friends and choose myself to trust altogether to the strongest young wood (cutting out every year some of the old) in order to procure the best and largest grapes."

I unhesitatingly assert that there is more valuable advice on grape pruning in the few pages devoted to that subject by Rev. John Lawrence than can be found in ten times the space in any modern work on the subject. No better advice can be given at the present day than that contained in the above extracts.

"A GENERAL TREATISE OF HUSBANDRY AND GARDENING, WITH A VARIETY OF CURIOUS CUTTS.—BY R. BRADLEY, F. R. S.: LONDON, 1724."

The author of this treatise was a very popular and prolific writer in his time, and published many volumes of useful and interesting knowledge, collected by correspondence from gardeners, and from books. Among others he published a treatise on the vine in 1728. Not having seen that work, we quote a short notice with one of his "curious cutts," which we find in this general treatise:

"While I have opportunity I shall take occasion to mention the French method of treating wall vines, which has little trouble in it, and will give us extraordinary fruit.

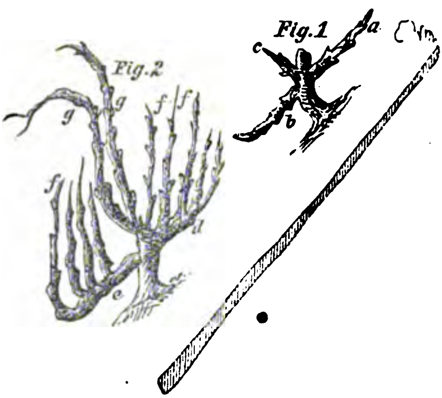
"In order to which we must bring our vines to shoot with vigor, that we may have two or three shoots of strength to lay to the wall for service; and this depends upon the pruning of the small shoots. For example, we will suppose we have a young vine planted in the spring, 1720, which at Michaelmas of the same year has shot two or three small twigs about the thickness of wheat straws; when these twigs have done their growth we must cut them down, so as to leave only one bud upon each shoot, so that the spring following, anno 1721, the sap, which by nature was designed to furnish all the buds on the twigs we cut off, will be employed only to nourish the few single buds which we left in pruning, and will fling those remaining buds into vigorous shoots, which in the vine are those that bring bearing branches. These shoots, proceeding from the buds in the spring 1721, will, at Michaelmas the same year, be at their full growth, and should not be broken or touched with a knife while they are in growth, for that will send them to branch, which should be avoided.

"When we come so far as Michaelmas, 1721, we are next to inquire what length we may prune the shoots of that year to when we lay them down to the wall; and that pruning we must order according to the strength of the shoots. If they are about nine parts in twelve of an inch diameter, they may be left about a yard and a half long; or if about half an inch in diameter, leave them a yard; or as they are less, must be shortened in proportion; but any of these must be left shorter if their buds or joints are close than if their joints are wide asunder.

"Fig. 1 shows us a vine pruned at Michaelmas, 1721, which had three vigorous shoots; *a* is one of them, laid down horizontally to run parallel with the border; *b* is the second shoot above it, pruned and laid to the wall in the same manner; and we are to observe that the shoots *a* and *b* are to produce bearing branches, anno 1722; *c* is the third shoot, pruned to two or three buds, which are left to

furnish shoots for laying to the wall at Michaelmas, 1722, at which time the shoots *a* and *b* are to be quite taken from the vine, unless a bud or two to supply the following year some shoots for laying down.

"Fig. 2 gives us the appearance of the same plant at Fig. 1 in its full growth, and the manner in which the shoots or bearing branches proceeding from those laid down anno 1721, ought to be nailed to the wall 1722.



"Now *d* in Fig. 2 is the same shoot as *a* in Fig. 1, and *e* in Fig. 2 is the same as *b* in Fig. 1. The letters *f f* show the shoots proceeding from them in 1722; and those shoots marked *g g* point those strong shoots which should be preserved to succeed the shoots *d e* when the grapes are ripe; for these, as I have observed before, *d e* must be taken away."

The above description is very lucid, although the sketch is not so exact. It may be more briefly described by stating that two strong canes are produced annually from the base of the plant, which are removed after giving a crop of fruit. A very efficient method of renewal, combining the advantages of an upright position for the young growing shoots and a horizontal position for fruiting them; a plan that cannot well be improved upon.

"A TREATISE OF FRUIT TREES.—BY THOMAS HITT: LONDON, 1755."

The author of this work was a practical gardener of great experience, and produced a treatise of much originality, with many valuable suggestions upon the general management of fruit trees, their pruning, training, &c. In his preface he apologizes for his want of school education, which he thought "too narrow for such an undertaking; but my friends persuaded me that polite expressions were not expected in such a performance, and therefore I flatter myself that its rude stile will be excused by the learned reader."

On pruning and training the grape he has the following remarks:

"I have always observed that the best season for pruning vines in winter is about the latter end of January or beginning of February, when the weather is dry, though it is customary to cut them immediately after their leaves are fallen off.

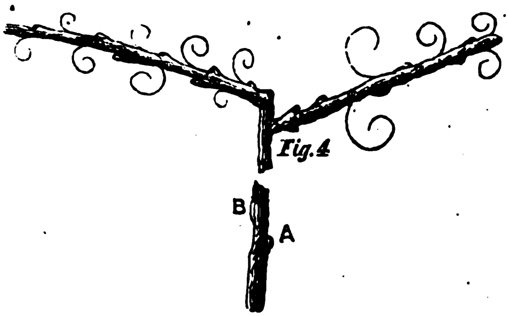


Fig. 1.

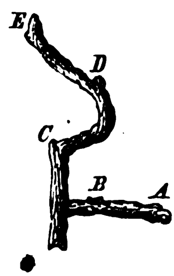


Fig. 2.

Fig. 1 represents a vine with only two buds, as at A and B, though there were others, lower; yet as two or three of the lowest buds are generally small and very

near together, they produce only small shoots, for which reason I think it is better to take them all off, and leave only two higher upon the branch, for they always put out longer shoots than those below. Fig. 4 represents a tree with two branches, supposed to have been produced from the buds A and B in Fig. 1, but they ought to be nailed more upright in summer than they appear in the sketch. Fig. 2 is a representation of Fig. 4 cut and nailed in winter, after the method I practice, with no other buds left on but those at A, B, C, D, E, though there were several others at the lower end of the stem, which are taken off, and some likewise from the under side of the branch A and B. Observe, these two buds at A and B are in such places as that the shoots proceeding from them may be nailed upright without being too near each other, and that at A may probably produce fruit; but those buds proceeding from the lower end of a branch seldom produce prolific shoots, for which reason I take them off, except one on the upper side, as that at B, from which a branch may be expected that will be fit for a horizontal the next year. But the others would not only deprive those at A and B of part of the juices collected by the roots, but also shade them from the benefit of the sun; and if the buds had been left on the under side there would have been room to have nailed up the branches without shading those above.

"Those buds at C and D are designed to produce shoots that will bear fruit, and the next winter, if long enough, they must be laid horizontally. That at E is intended to lengthen the stem, and in winter must be turned in the manner represented by Fig. 3. By giving the stem such curves, it will occasion branches to break out of the old wood, which can be laid down to produce fruit the following summer.

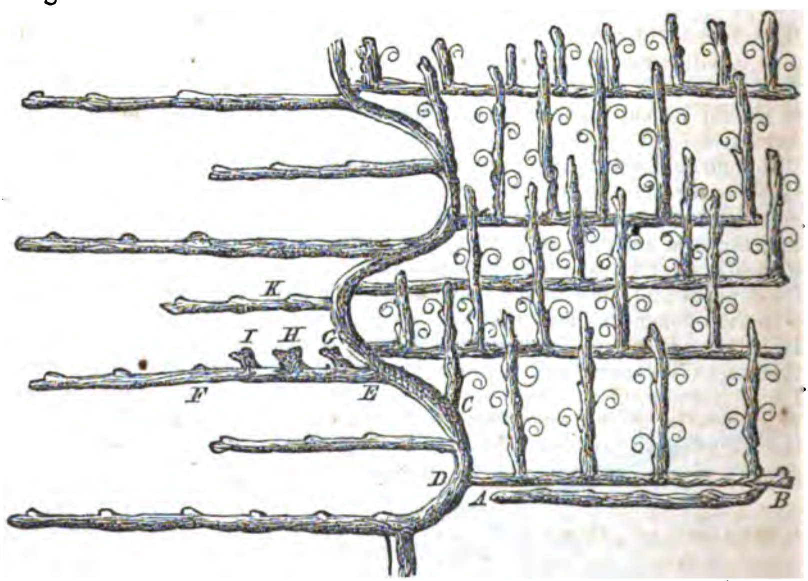


Fig. 3.

"The side A in Fig. 3 represents the branches nailed up in the summer, as when the fruit is upon them; the other side shows how the vine must be cut and nailed in the winter, with no buds upon the branches, but in places where shoots are required; all those buds nearest the stem, and on the under side of the branches, are taken off with the point of a sharp knife, when the branches were nailed up in winter, for then it is known what distance the next year's shoots ought to be from one another, and I leave buds in no other places but where shoots are desired, but there should never be too many left on.

"Always observe to provide branches for new horizontals where wanted, for the old ones should not remain longer than two years, but it would be better to have fresh horizontals every year, for the less length of old vessels the sap passes through, the larger the bunches of fruit will be.

"The lowest branch on the side D was a shoot made the last year, having all the buds taken off from the under side, but has all left on the upper one, all of which, I expect, will produce bearing branches, except that nearest the stem, which, if it shoots strongly, must be preserved of a length sufficient to make a horizontal the next winter.

"The short branch above D was obtained from the stem the last summer, as also that at C, on the other side; and as there was not an opportunity to lay in a new horizontal at E, I therefore left this shoot above D to produce bearers, in order to cover the naked part at E, F, where the branches that bore the last year are taken off from the horizontals; but if the other end has buds upon it, and was of the bearing shoots the last summer, all the parts above are cut and nailed by the same rules, as ought also the side A to be.

"But if it happens that there is not a shoot of a proper length near the stem, to be laid for a new horizontal, as that is above D, then, instead of taking the branches quite away that bore the last year upon E and F, they ought only to be shortened about two inches above the first large bud at their lower end; after that nail them leaning as much as they will bear without breaking, and all the small buds below must be taken off with a knife-point, leaving upon each shoot one bud only, as at G, H, I; when this is done there is no need of one at K. Sometimes it happens that many of the shoots which bore in the summer are weak at the time of winter pruning, and perhaps but one strong one at the end of a horizontal. When that is the case, I turn it quite back to the stem, or as near as it will reach, as that near B is supposed to be turned below the horizontal to A, and then the two middle branches should be cut off close, but that next the stem should be cut like that at G, with one bud on, to make a shoot for a new horizontal the next year.

"Though the branch from B to A is laid below the old horizontal, yet it is not always required to be so, for it would grow as well had it been above; but I always contrive to lay the new horizontals at about half a yard from each other, and if they be close to an old one it is not the worse. When there is not a branch of any sort near the stem, then as near to it as possible. I have twisted the old horizontal quite round, before the branch was turned from B to A, and this method generally had the desired effect."

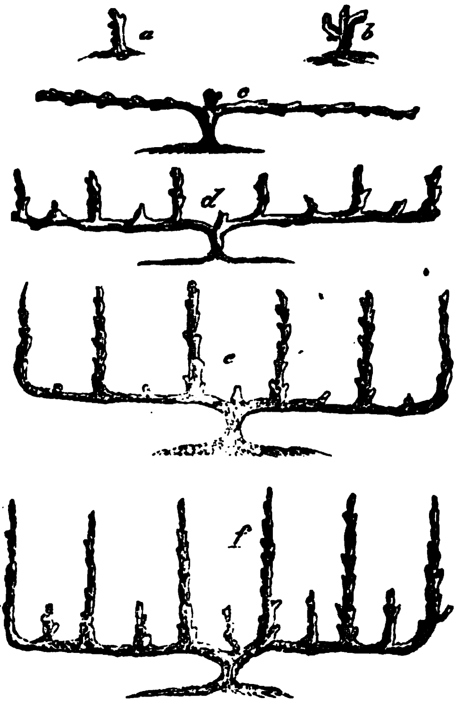
It will be observed that there are two important points insisted upon by the author: first, the necessity of fruiting on young wood procured by cutting out old and introducing new horizontals, so that the fruit is constantly produced on strong growths of the preceding year; and, secondly, the cutting out at the winter pruning all buds on the shoots retained, except those required to produce fruit or furnish the requisite young canes for the future.

"A TREATISE ON THE CULTURE OF THE VINE.—BY WILLIAM SPEECHLY: LONDON, 1779."

This author has been termed the Moses of modern grape-growers, and his name is frequently mentioned in connection with the largest bunch of grapes that has been produced since his time; having grown a bunch of the Syrian variety to weigh nineteen pounds. The method he recommends in order to have large, fine fruit, and healthy plants, is as follows:

"The vine when planted is cut down to two eyes or buds, (*a*); the next winter the shoots of the preceding summer are shortened each to one eye, (*b*); two leading shoots are produced, trained upright during summer, and in the following winter headed down to form three to five feet each, and laid in horizontally

parallel to the ground, and about a foot above it, (*c*); these main stems produce shoots from every eye, but only a few are selected, which stand from a foot to fifteen inches apart, and these are trained upward during summer, and in winter every other one is cut out to within two or three eyes of the main stem, and the rest shortened to one-third of the length of the trellis, (*d.*) The following summer, the third, a moderate crop will be produced from the side shoots of the wood of the preceding year, and from the buds on the main stem. In the winter following the shoots which have produced the fruit are shortened down to two eyes, excepting the leaders to the long shoots, which are left with four or five eyes, (*e.*) Next summer, the fourth, the top of the trellis will be reached by the leading shoots, and the spurs are now allowed to produce each one leader. In winter both of these leaders are headed down to four or five eyes, and the side shoots from the old wood to one or two eyes, (*f.*) In the following summer, the fifth, a full crop of grapes is produced. This constitutes one course, or rotation, and the next, and all the future courses, extend only to four years, in which the object is to renew the upright bearers every fourth year, the intervening spurs furnishing shoots to succeed them."



The above method of Speechly is one frequently recommended at present, but is deficient in so far as no provision is made for renewing the horizontal stems, for, although the system will do well for a few crops, yet no system that does not include frequent, complete renewal of the old wood, will maintain a high fruiting condition.

"A TREATISE ON THE CULTURE AND MANAGEMENT OF FRUIT TREES.—BY WILLIAM FORSYTH: LONDON, 1791."

The author of the above work gained considerable reputation on account of a composition which he used for covering the wounds of old headed-down fruit trees; the renewed vigor the trees received from pruning and manuring the soil being by him mainly attributed to the said composition. For this he received a reward from the British government.

Forsyth's mode of training the vine resembles in some respect that of Speechly; he does not, however, recommend so systematic a treatment, and trains the young shoots in a serpentine-form, a mode he strenuously advocates.

In pruning he remarks: "Make choice of the strongest and longest shoots, leaving them as long as the eyes are found good and plump, and the wood round, but never leave them when they become flat.

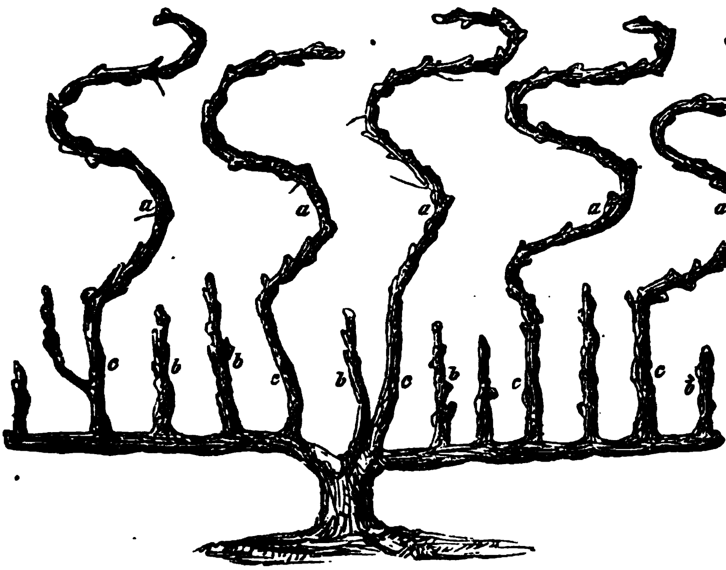
"The shoots that bore fruit in the preceding year should be cut out next year, except when the trellis is to be filled and the shoots are very strong. A plenty

of fine, healthy, young wood is always to be had; therefore, never leave any but fine strong wood, always cutting at the second, third or fourth eye.

"Always have two or three of the strongest shoots for next year's bearing wood, and never top them if there is room to train them.

"The wood must be strong, or the vines will produce small bunches. If the shoots are weak, cut them down to two or three eyes, in order to have strong wood for the next year."

The following is his method of pruning and training, "*a a*, the young bearing wood of a vine trained in a serpentine manner, with the buds for the present year appearing. These shoots are generally cut out in the winter pruning, as low as *c c*, to produce wood for next year. The shoots *b b* produce fruit in the usual



manner; also young wood for the following year, which must not be topped, but only have the side shoots picked off. Two or three of the strongest young shoots from each of those, *b b*, will be sufficient, and they must be laid in at full length."

As already remarked, Forsyth is not so systematically neat as either Hitt or Speechly, but the principle upon which he operates is the same.

"THE AMERICAN GARDENER'S CALENDAR.—BY B. M'MAHON: PHILADELPHIA, 1806."

This author prefers to prune vines in February; his directions for training and pruning against walls, trellis, and espaliers, are as follows:

"In order to have well formed espaliers and wall vines, &c., you must train the two first good shoots produced by the plant, horizontally, one to each side, within a foot or a little better of the ground, and continue them in that direction from year to year, to whatever extent you may think desirable.

"The first year these must be deprived only of the decayed wood on the extremities, and of any secondary shoots proceeding from the axils of the leaves, unless they have run to the desired extent; the second year they will produce shoots from the joints, which are to be trained either upright, serpentine form, or fan fashion, according to fancy, at the distance of about eight inches from each

other; the third year, head each of them down to one good bud, and train them up as before directed; the fourth, and every succeeding year, make choice of the strongest shoots, say every third one, and head them down to from ten to twenty buds each, more or less, according to the strength of the mother plant. The other shoots are to be headed down to one or two good buds each, which are to produce young wood for the next year's bearing, as those left to bear this season must be cut down next, in order to produce a succession of young wood, and so continue in their management from year to year."

The above is the mode at present known as the *renewal*, which answers well for a few years, but is objectional so far as not providing for a renewal of the *horizontals*.

"THE SCIENCE OF HORTICULTURE.—BY JOSEPH HAYWARD, GENT: LONDON, 1818."

In his prefatory remarks the author states that on all occasions he has reverted to nature, and to original and elementary principles of causes, and hence, tracing effects by regular demonstrative experiments, he has been enabled to deduce and arrange a system of practice which has produced the most desirable results. He also acknowledges his indebtedness to Hitt for the first ideas of establishing fixed principles for the general management of fruit trees.

With regard to the grape he has the following:

"The vine is a creeping plant and requires support to enable it to arrive at maturity in the production of its fruit, and differs materially in its habits or nature from all the other fruit trees; and unless this is duly considered, and perfectly understood, it will be impossible to train it to the utmost advantage. I shall, therefore, state in four propositions, or theorems, what I consider to be the laws of nature, as explanatory of the mode of training.

"First. The vine bears its fruit upon shoots of the same year, produced by branches of the preceding year.

"Second. The strongest and best ripened branches produce the largest quantity and finest quality of fruit.

"Third. In whatever position the branches of a vine are laid, whether horizontal, oblique, or perpendicular, the strongest branches are always produced at the extremity of a last year's branch, the two extreme buds generally forming shoots of equal strength.

"Fourth. Those branches which are the furthest from the root ripen the best, and are the most prolific.

"A method of training the vine conformable to those principles was, in the year 1808, transmitted by me to Mr. Knight, who caused it to be published in the transactions of the London Horticultural Society, and there stated to be taken from Hitt; but, on comparison, I think this method will be found much more conformable to the principles I have explained than that of either Hitt or Forsyth, and calculated not only to produce an equal quantity of fruit for the first few years, but to continue for any length of time to cover the same space of wall or frame with the same quantity of fruit annually, and, at the same time, to extend it to any distance required. It will be seen that, by adhering to the principles I have explained, the whole of the sap supplied by the roots will be applied to the most profitable purpose, the strongest shoots will be formed on the ends of those shoots which were the strongest, and left to produce bearers the last year, and on the spurs left for the purpose; and as these will be the only wood branches on the root, the whole of the sap flowing to them will not only give them the utmost strength, but, as it must pass the fruit branches, the fruit will, in consequence, be well supplied and supported.

"From the peculiar direction of those branches, the position is not only the most congenial for the leaves, which have ample space to be allowed to be

trained up perpendicularly between the horizontals, but the strongest shoots will be produced in the exact situation to form bearers for the next year, to fill the space with fruit which was so occupied the last year, and to extend the tree.

Fig. 1.

Fig. 2.

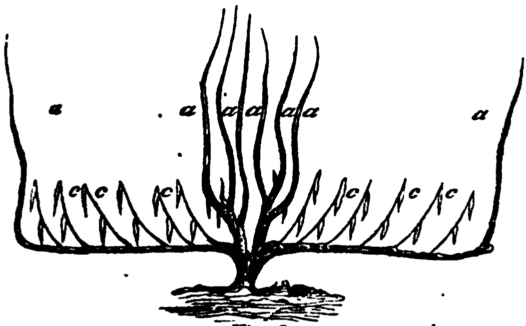


Fig. 3.

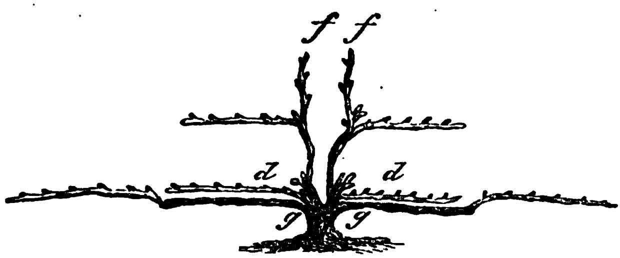


Fig. 4.

On those principles, a vine grown during summer, as represented at Fig. 1, will at the winter pruning appear as at Fig. 2. The sharp spurs marked *f f* are necessary to furnish two extreme buds, to produce the two strong shoots which will be wanted the next year—one to cover the old bearer as marked *d*, in Fig. 4, and others to be shortened to form extreme buds, as *f*, for the following year. Those strong shoots or leading branches marked *a* in Figs. 1, 3, and 5, must be carefully fixed as they grow during the summer, and by no means be shortened; for if they are shortened or stopped during the summer or spring, those buds which would otherwise form the branches to produce fruit the following year will burst prematurely, and the fruit be lost. The collaterals which are thrown out must be taken off from time to time as they appear, not close, but pinched or cut off a little above the first joint. This attended to, and the branches trained into the most convenient place to be exposed to the sun, they will become sufficiently hard and ripened without removing any of the leaves which cover the first buds. And it may be necessary to observe that the leaves must not be removed or taken off on any account, for those buds which have been deprived of their leaves seldom produce fruit.

"The bearers marked *c* in the figures, being trained up perpendicularly, must be shortened by pinching or cutting off their tops about two or three joints above the fruit, and all barren branches must be taken away close to the old wood. At the winter pruning, which I recommend to be performed as soon as the fruit is ripe and gathered, all the branches that bore the fruit must be cut off close to the

old wood, and the strong wood branches or leaders which have been trained for the purpose be brought down and fixed close upon the old branches, and shortened so as exactly to fill the same space, with the bearers, the next year, which they did the former. See *d*, in figures.

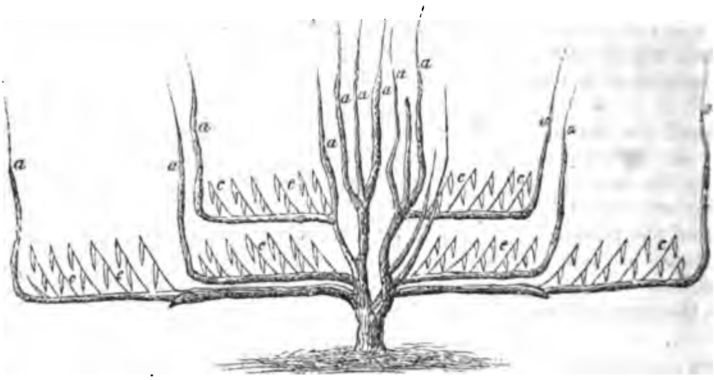


Fig. 5.

"Pursuing this method, any space may be filled, and when it is so, by cutting off the oldest branch close to the root or stem, as at *g* in Figs. 4 and 6, and removing it, the plant will be the same as it was the last year, with the waste of one horizontal and bearers only.

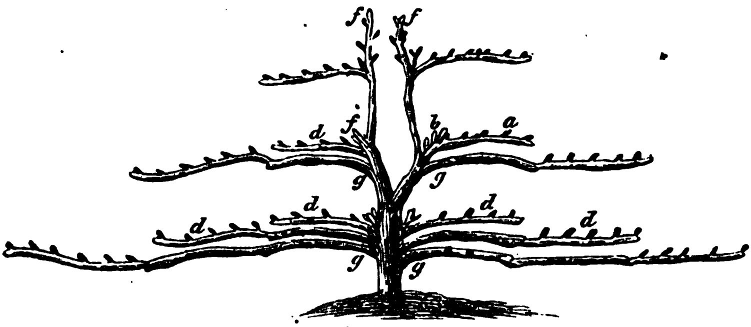


Fig. 6.

"In this manner a vine may be continued to fill the same space, to present the same extent of surface, and (barring accidents and unfavorable seasons) to produce the same quantity of fruit annually, for any length of time. The only encroachment upon the original space will be by the old wood or branches, and as these must be laid close one on the other, this will be but trifling.

"Forsyth's remark that 'the vines were trained upright, which caused them to grow so luxuriantly that the sap flowed into the branches instead of the fruit,' seems a very superficial idea, and expressed without much consideration; yet it is very generally acted on, and I believe is the grand cause why the grape-vine is rendered so unproductive.

"And that the fruit may be larger and finer flavored, vines are annually cut back close to the root, and curtailed so as to produce a small number of branches and bunches only; but these appear to be erroneous conclusions, and as contrary to reason as to nature.

"There are to every operative maxim two extremes and a medium, and thus, although by lessening the number of bunches of grapes in a certain proportion, we still obtain the weight of fruit; or, in other words, supposing that if four bunches of grapes were left on a tree, they would attain the weight of four pounds, or one pound each, and that if two bunches were removed the other two would take the supply and become two pounds each, or four pounds together, it is not to be concluded that if three had been taken away the remaining bunch would attain the weight of four pounds; for, if two pounds be the utmost weight of a bunch, by taking away the third bunch we lose half the produce."

Although the sketches by this author are rather scratchy and not very exact, yet they are sufficiently clear to an understanding of his method. He recognizes very fully the principle of taking fruit only from strong terminal growths, and providing successional shoots by removing old canes, and thus renewing the plant; and the principle can be applied to any mode of trellising or training to single stakes or poles. The mode of training shown in the figures may be modified, but the principles of pruning here explained are valuable, and the practice the best that can be adopted.

EXTRACTS FROM "LOUDON'S ENCYCLOPEDIA OF GARDENING:" 1825.

"In estimating the merits of the different modes of pruning and training the vine, Mr. George Lindley, in his 'Guide to the Orchard,' has the following very judicious observations:

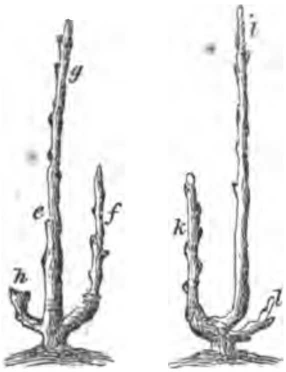
"'As the ultimate object of every method of pruning and training must be supposed to be the obtaining a large crop of good fruit, it is material to consider how and by what means this is to be effected, and whether it is desirable to grow a large number of bunches or a number of large bunches, the weight of the whole of each being the same. I have myself ever been an advocate for large fruit, or the largest size to which any particular fruit usually attains, being fully satisfied that the value of fruit is more to be estimated by its individual bulk or weight than by the number of individuals composing that weight. If, then, we are to consider the maximum of merit to consist in the attainment of the largest sized fruit, this can be best accomplished by having the vine in a vigorous and flourishing state. This state is to be attained (all other circumstances being favorable) by the alternate system of fruiting one shoot every year, to be cut down at the winter pruning, for the purpose of furnishing a shoot the following year to succeed it.'

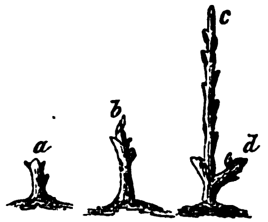
"This, in short, is on the same principle as that termed by McPhail the long or new method of vine pruning, what Speechly called the alternate system, and by Mearns the long or succession mode of pruning vines.

"McPhail, writing in 1794, remarks that he 'learns from books that it was in practice forty years since,' and is thus described as practiced in the grape house, which applies with equal force to vineyard pruning:

"'The vines when planted are headed down to within a foot of the soil, *a*. One shoot only is allowed to proceed from each plant, which, at the end of the first season, is cut down to the second or third eye, *b*. Next year two leading shoots are encouraged, the strongest of which is stopped when grown three or four joints beyond the middle of the roof, and the weaker after having grown three or four feet, for the purpose of strengthening the eyes. At the fall of the leaf the leading shoots are reduced, the main one to the length of the middle of the roof, *c*, and the lower to the third eye, *d*. In the third season one leading shoot is trained in from each shoot, *c* and *d*, and from the bearing shoot, *c*, fruit-bearing side shoots are produced. No side shoots are allowed to proceed from the spur *d*, the leading shoot from which becomes bearing wood for next year. Thus, in the autumn of the third season, the lower part is furnished with fruit

from shoots proceeding from wood of the preceding year, *e*, and parallel to this bearing shoot is the young wood for next year's crop.





"In winter, the shoot from the extremity of the bearing branch (*e*) is cut off at the top of the trellis, or within a foot of it, (*g*,) and the shoot *f* from the spur *d* is cut down to the middle of the trellis, and all the spurs on *c* which have borne grapes are cut out. Each vine is then furnished with two shoots of bearing wood, (*g*, *f*,) a part of old wood, (*e*,) and a spur for producing a young shoot the following year, (*h*.) In the following summer a full crop is produced from the young wood at *g* and *f*, and a leading shoot allowed from *h* and *f*. In the pruning season of this year the centre shoot is entirely removed and replaced by *i*, the latter being in turn replaced by *k*, while *l* is prepared to supply another new shoot. This constitutes one rotation or period of system."

The above mode, so clearly described, embraces the true principles of grape pruning, and reaches the same conclusions as that of Hayward—indeed, is exactly his system trained on upright posts.

"A PRACTICAL TREATISE ON THE CULTIVATION OF THE GRAPE-VINE ON OPEN WALLS.—BY CLEMENT HOARE. REPRINT: NEW YORK, 1847."

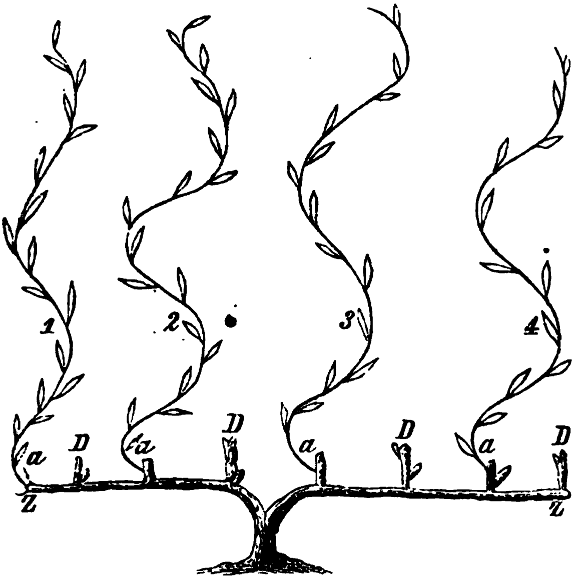
Mr. Hoare remarks, "that as the sole object in view in pruning a vine is to increase its fertility, the best method to accomplish this must be that which leaves a sufficient supply of bearing shoots on the least possible proportionate quantity of old wood."

The mode by which he proposes to accomplish this he terms long pruning, and is thus described:

"This method consists in obtaining all the fruit of a vine from a few shoots, trained at full length, instead of from a great number of spurs or short shoots. To provide these shoots, the former bearers are cut down to very short spurs at the autumnal pruning, and, at the same time, a sufficient number of shoots are left at whole length to produce fruit in the following year; at the succeeding autumn these latter are cut down to very short spurs, and the long shoots that have pushed from the spurs are trained at whole length as before, and so on annually in alternate succession.

"When the shoots are nailed to the wall in the early part of the year, those which are trained at full length as fruit bearers are, in all cases, to be cut down to the lowermost bud or two at the next autumnal pruning. With respect, therefore, to all such shoots, no greater supply of sap should be permitted to flow into them than is necessary to mature their fruit, as all above that quantity will be so much nourishment uselessly expended, and taken, indeed, from the young shoots that are to be produced in the current year for future bearers. For example, if the shoots 1, 2, 3, 4 in the figure were trained in straight lines, the sap would ascend with such force, that many of the lowermost buds would scarcely break at all, the sap passing by them, and accumulating in those at the upper part of the

shoots, which would burst with great force, and form very strong shoots; these would rob all the fruit on those below of its due share of nourishment, and also



the shoots emitted from the spurs D; which, to form good bearing wood, require as great a supply as the fruiting shoots. It is true, that, by pinching off the extremities of the latter ones, in the spring, an eye or two above the last bunch of fruit, the sap will be partially kept back; but the ascending current having set in very strongly, it cannot be diverted, except in a comparative degree. But if, as represented in the above figure, the shoots be trained in a serpentine manner in the early part of the year, before the sap is in motion, it will, in its ascent, be thereby made to flow more equally into all the fruiting shoots that push from them, and also into those which will be omitted from the spurs D for future bearers. And by bending the bottom part of the shoots pretty circularly at *a*, the buds will there burst strongly, and thus a good supply of bearing wood will be obtained close to the arms Z, Z, which is of primary importance; for if, by injudicious training or pruning, or both combined, the sap have an opportunity of exerting its full force at a distance from the arms, it is sure to embrace it, and the consequence is, that blank wood begins immediately to be formed in all directions near the stem; and when that is the case, no method of pruning will ever again procure a supply of bearing wood at home, short of that of cutting the vine down to a perfect stump.

"For the foregoing reasons, therefore, the method of serpentine training may be considered preferable to every other, being calculated in a greater degree to check the too rapid ascent of the sap, and to make it flow more equally into the fruiting shoots, and those intended for future bearers."

EXTRACT FROM THE "FLORIST AND HORTICULTURAL JOURNAL:" PHILADELPHIA, 1853.

"Among the various systems of pruning and training the grape, it seems there are scarcely two authorities alike. This is much to be regretted, and arises chiefly from the fact that the grape *will* produce more or less fruit, under any system of management, when the plant is young; consequently, those who make a first attempt at its culture, if they procure even a small crop, are so overjoyed

with their success that they extol it to the world, and chronicle their results as proceeding from some trifling circumstance, which is henceforth considered indispensable.

"We propose to offer a few remarks upon various systems of pruning now in vogue, and before proceeding to details, a few preliminary remarks will be necessary.

"When a seed germinates, its first effort is to send roots downward into the soil, which is immediately followed by an upward elongation in the air, forming stem and leaves; the starch contained in the seed affords sufficient nourishment for this process; but as soon as leaves are developed, the plant is dependent upon the soil and the air for its further support. The elementary matter absorbed by the roots undergoes decomposition in the leaves, and becomes fitted to extend the formation of the stem and roots. This relative action continues during the growth of the plant. Its increase in size, the quantity of its secretions and extensions of roots, are the result either of the immediate or previous elaborating functions of foliage.

"Such is the generally recognized process of vegetable growth. Leaves are the principal agents; any system of pruning, therefore, that involves their removal during their season of most active growth, must exercise a corresponding check to the growth of the root; the greater the amount of large, healthy leaves, the more strength and vigor imparted to the roots; and if these principles are kept in view, we shall be better able to discuss the merits of pruning in all its modifications.

"The *spur* system of pruning is advocated and practiced by many at the present time. This may arise from its simplicity—certainly not from any physiological superiority it possesses. According to this method, a single shoot is encouraged to extend from year to year, until it fills the alloted space; the fruit-bearing shoots are the side branches that proceed at intervals from this main stem; these side shoots at the annual winter pruning are all cut off except one eye-bud, which is left to furnish the fruit-bearing shoot the following season. During growth the points of these shoots are pinched out at one or two leaves beyond the fruit bunch, and all future growths are carefully checked. This is done with a view to benefiting the growing crop, and also to concentrate the sap and fill up the lower eyes. The whole system involves a continual suppression of growth, and, as a natural consequence, the roots are also checked, become more woody at their extremities, and lose their power of absorption. A young plant, well established in good soil, will continue in health and productiveness for several years under this treatment, especially while the leading shoot from the main stem is allowed to extend, thus furnishing a considerable amount of healthy foliage, and keeping up an active extension of root growth; but when the main shoot has reached its desired length, and nothing but the side shoots permitted to grow, the plants gradually become weaker, the lower eyes fail to burst vigorously, and the bunches become small and imperfect. We are sure this statement will be indorsed by all experienced, observant grape-growers who have practiced this system for a series of not less than six to eight years.

"The next system we will mention is *alternate spurring*. This method is an improvement upon that just described, and may be briefly explained as follows: In spur pruning the shoot is cut down to one eye or bud, thus sacrificing more prominent and better developed buds further from the stem; to secure the advantage of these, the most promising bud is selected and the shoot cut back to it, without reference to its distance from the main stem; at the same time all the other eyes or buds on the shoot are picked out with the knife, so as to prevent their growth, except the one nearest the main stem.

"When growth commences, the two buds thus retained form two shoots, of which the uppermost bears fruit, the lower one merely forming a shoot to furnish buds for next year's crop; any fruit appearing on this to be removed.

"The summer management of these is exceedingly simple. The fruit-bearing shoot has its point pinched out two or three leaves beyond the bunch. The non-bearing shoot, from the lower eye, is also stopped at the point when it has grown to the extent of ten or twelve leaves; when the fruit is ripe and gathered, the shoot upon which it was produced is at once cut off. This is done with a view to strengthen the buds of the non-bearing shoot. At the winter pruning this last-mentioned shoot will undergo the same treatment as its predecessor, viz., pruned down to the most prominent bud, all others being removed except the lower one.

"This system provides a larger amount of foliage than is the case with close spur pruning; it also furnishes finer fruit, from the circumstance of well developed buds being selected for the fruit-bearing shoots, but it is faulty in so far as there is no annual extension of the main stem, nor any renewal from the base of the plant; consequently the lower shoots annually become weaker, and the roots suffer from lack of the benefit of vigorous foliage.

"To insure permanent crops of the finest fruit, we are of opinion that the long cane renewal system is preferable to either of the above modes; indeed, we consider it the *best* method of grape pruning.

"In the management of vines on this system, the vine, after being set out, should be allowed to extend during the summer almost at random; this will tend to establish a strong base of roots. If the plant is not of sufficient strength to bear a few bunches of fruit, it should be pruned close down to within a few eyes of the root at the winter pruning. This will cause it to throw out a vigorous cane the following summer, on the well-known principle in vegetable physiology, that winter pruning strengthens a plant, and summer pruning weakens it. When the yearly growth has reached a fruit-bearing size, it should be cut down in the winter pruning to five or six feet in length. The following summer this shoot will produce fruit; the summer treatment will consist in stopping the fruit-bearing shoots at the second or third leaf beyond the bunches; this will tend to enlarge the fruit. The top shoot should be allowed to grow undisturbed, unless it is very luxuriant; if so, it may be stopped when it has made six feet of new wood. An additional cane is also to be encouraged from the base of the plant, and treated similar to the main growth of last year.

"At the winter pruning the side shoots that produced fruit are to be completely removed—not cut to a spur, but taken off close to the old stem; the two leading shoots are both to be cut, so as to leave from four to six feet of young bearing wood. The third season there will be a good crop of fruit produced on separate canes; that is, on the wood left on the cane grown from the base last year, and also on the young growth on the end of the oldest cane. The summer pruning this year will consist in pinching the points out of the fruit-bearing shoots, as before; all growth should be checked on the lower portion of the old cane, except that a shoot is to be encouraged from the base, to form a new cane as before.

"At the winter pruning the oldest cane is to be removed altogether, and the system is established; a fresh cane is yearly taken up from the base of the plant, and an old one is yearly taken out after it has fruited for two years.

"This mode can be extended so that three crops of fruit are taken from each cane before cutting it out; indeed, it admits of various modifications; but one thing should never be lost sight of, and that is, to grow a young cane yearly directly from the base of the plant.

"The advantages to be derived from a system of renewal are, first: The young growths that are produced yearly keep the roots in constant healthy action, in consequence of the large area of healthy foliage maintained; secondly: The fruit-producing portions of the canes can be managed in summer as if on the spur mode, and the fruit receive all the advantages of stopping the shoots producing it without checking the extension of root growth; thirdly: It is considered that the fruit is less liable to mildew when produced on young, vigorous wood; and, fourthly: The removal of a cane in winter, after leaves have performed their

yearly functions, tends to keep the balance of growth in favor of the roots, and enables them to produce strong shoots.

"In any kind of spur pruning upon permanent stems, the plants will yearly show less and less vigor. On the contrary, when managed on this mode of renewal, vigor is constantly maintained. It is not a new method; indeed, it was at one time the common system; but since the introduction of excessively rich borders, and the consequent production of very luxuriant wood, a few good crops are produced, even if the stems are cut as smooth as a walking-cane; and although we at one time had a very high opinion of spur pruning, more extensive observation and experience have fully convinced us of its inferiority when compared with a system of renewal."

"CULTURE OF THE VINE.—BY DR. J. GUYOT: PARIS, 1860."

The general system of pruning and training recommended in this work is that of frequent renewal of young wood and fruiting the branches horizontally, but keeping them in a vertical position the first year. We extract as follows:

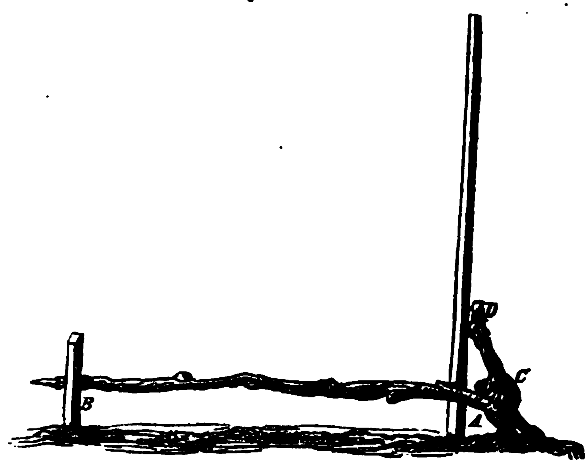
"Each vine should produce, each year, at least one branch for wood and one for fruiting. The fruiting branch should be trained horizontally, near the ground, and attached to an iron wire, or trellis of wood.

"The branch that has borne fruit should be cut away yearly, at the time of dry or winter pruning.

"The fruiting shoots should be pinched off, by aid of the thumb, above the sixth leaf; the shoots of the branch for wood should not be pinched. The branch for wood should produce each year two sprouts or vines, one to replace the branch which has borne fruit, and which should be cut away; the other, cut back so as to leave only two eyes, will become the branch for wood, and will produce the two shoots necessary for the succeeding year."

"The following engraving represents a vine winter-pruned, according to the above rules. A B the branch to bear fruit, attached at B to a small prop, and the branch for wood, C D, destined to furnish shoots for future bearing branches; these last are trained vertically to the stake during summer, and take the place of A B, the following winter, when A B is cut away."

It will be observed that, while there are various modifications in the operative details, as recommended by the different authors enumerated in this paper, they all agree in the necessity of renewal, and that so far from the system being of recent introduction, it has been practiced for ages.



I remarked, at the commencement, that, even under very indifferent treatment, young vines will give good results for a few years. This gives a reason for the multiplicity of so-called systems of vine management that have, of late years, been introduced. The trial of such systems has only extended for a few years previous to their recommendation; and instances can be pointed at, where failures, the most complete, have occurred simultaneously with the most eulogistic advocacy of the system.

GRAPE-GROWING AT THE WEST.

BY R. O. THOMPSON, NURSERY HILL, NEBRASKA.

HAVING been engaged in grape culture and the testing of over one hundred varieties, in Nebraska, with some observation of varieties, product, and hardiness in Missouri, Iowa, and Minnesota, I propose, in the following pages, to give my experience of growing the grape in open-ground culture, as I have had no experience of cultivation under glass in any stage of growth whatever.

The location in Nebraska, where tests were made, is a high rolling prairie; on the east, south, and west entirely exposed; on the north, a grove of timber, lying so low, however, on the bottom of the Nemaha river, its effect on production was scarcely felt, as the level of the exposure was nearly on a level with the tops of the highest trees. The location is north latitude 40° 39′ 43″; height above the sea at the mouth of the Mississippi river, 1,266 feet; west longitude 18° 50′ 43″.

The land is a black, rich soil, eighteen inches to two feet deep, very light and porous, and the plough or cultivator could be used in less than half a day after a heavy rain of two hours. The prairie was broken up in June, and allowed to lie until the next April; then cross-ploughed and thoroughly harrowed until it presented a well pulverized surface.

It may be well enough to state here that at no time in the course of these experiments were there any frames set or protection given to any of the vines; all were exposed to the extreme of 108° in summer, to 30° below zero in winter.

Concord, Clinton, Catawba, Isabella, Delaware, Diana, Union Village, and Taylor's Bullitt were planted six feet apart each way. The vines were two-year layers, all good, thrifty plants, and set from 18th to 25th of April.

Concord and Clinton, the same season, set a number of blooms, but I rubbed off all save two to each vine. The others bore no fruit; all made a vigorous growth, and ripened up from six to eight feet of fine wood, except the Delaware, which made a feeble growth and ripened but two feet of wood.

The Catawba, Isabella, Delaware, Diana, and Union Village were thrown down from the stakes, while the Concord, Clinton, and Taylor were left upon them. All were cut back or pruned the last of February. Every vine, except the Isabella and Union Village, wintered in the most satisfactory manner; but the two named were very much damaged. The three coldest days of that winter were a mean of 14° below zero.

In the spring the Concord, Clinton, and Taylor bore full crops; a few bunches of Catawba and Diana, very fine fruit. The Isabella, Delaware, and Union Village did not set a single berry.

In the spring of this season I set the Ontario, Oporto, Rebecca, Marion, Logan, Kitchen, North America, Herbemont, Hartford Prolific, Franklin, Coleman's White, Emily, Clara, Canby's August, Cloantha, Canadian Chief, Anna, Allen's Hybrid, and Alvey. These were good plants, and all made a good growth except the Anna and Rebecca.

In November I pruned all of spring setting, and the Diana, Union Village, and Isabella, and left the others upon the stake; covered all that were laid down with three inches of soil. The winter was a severe one, and the Taylor, Catawba, and Delaware were more or less damaged, but all produced a little

fruit except the Delaware. The Concord and Clinton came forth unscathed, bore fine fruit and full crops, all ripening well.

Now we must look after our last setting; the Marion, Oporto, Hartford Prolific, Franklin, Alvey, and Kitchen came out all right; the others were more or less damaged, though all were well covered up. No yields of fruit from any of the last setting, except from the Marion and Franklin. The fruit of the Marion was tough and sour. The Franklin proved a very fair grape when fully ripe, yet the bunches were small, though round and compact. This spring I set Miller's Burgundy, Blood's Black and White, Cassady, Child's Superb, Cuyahoga, Brandywine, Baldwin, Albino, Elizabeth, Wright's Isabella, Christie's Isabella, Northern Muscadine, Mary Ann, Louisa, Lenoir, Red Traminer, White Scuppernong, White Sweet Water, Los Angeles, and To Kalon. In the fall I covered all of this setting and that of the previous year, and two each of Isabella, Union Village, and Catawba. All were opened about the middle of April. The vines of all varieties that were covered, wintered well. The Concord, Clinton, and Taylor were wintered perfectly and bore large crops; Delaware ripened a few bunches of small fruit of the best quality; the two vines each of Isabella, Union Village, and Catawba, which were covered, bore very fine specimens; the unprotected vines not a berry. Of the second setting every variety bore fruit, except the Rebecca and Anna; the Union Village and Ontario proved to be the same.

The Oporto showed vigorous growth; berries, medium size, black, acrid, sour; bore a large crop. Marion, two varieties under this name; one, a northern red fox grape; the other, a black grape of medium size, with light bloom, very sour and foxy, and of no value whatever, wine made from it being inferior at eighteen months old to that from the wild grapes growing along our streams.

Logan, the berry large and showy, but the fruit of poor quality. Kitchen, large bunch and berry, of second or third-rate quality. North America, of medium size, black; bunch small and compact; sweet and good when allowed to remain long on the vine, but quite foxy.

Herbemont, berries small, dark blue; fruit first-rate; ripens late.

Hartford Prolific, large berries; bunches, medium; very early; fruit sweet and good, with a foxy flavor, yet every way desirable. Franklin, fruit and bunch small to medium, black, and good when the fruit is exposed to frost.

Coleman's White, a few bunches of insipid fruit.

Emily, two small bunches of red fruit. This grape should be classed with the last named.

Clara, bunches large; fruit medium, white, very fair quality.

Canby's August, (or York Madeira,) fruit small, black, and very early, but of no use as a table grape.

Cloantha, fruit very much the same as Isabella; vine apparently the same in wood and leaf; the fruit is foxy, but quite palatable.

Canadian Chief, fruit quite large; very late; did not ripen at all.

Allen's Hybrid, bunch large; fruit medium, nearly amber color, tender flesh, and of good quality.

Alvey, bunches large, berry small, a fair grape, and good wine in small quantity was made from it.

This winter I again covered all of the last season's setting, and threw the others upon the ground. The Ontario, Marion, North America, Hartford Prolific, and Franklin wintered well, while the Rebecca, Logan, Herbemont, Cloantha, Coleman's White, Emily, Clara, Canadian Chief, Anna, and Allen's Hybrid were killed outright, or so nearly that but few sprouted up. The Kitchen, Alvey (or Hagar,) and Canby's August were killed to the ground.

Of the first setting, the Catawba and Diana bore but little fruit; the Isabella and Union Village were entirely killed. The Delaware was very much injured; only a few bunches of fruit.

Taylor, Concord, and Clinton proved entirely hardy, and yielded a full crop of well-ripened fruit.

I again covered all of the last setting, and opened in the spring with Red Traminer, Miller's Burgundy, White Scuppernong, Los Angeles, and White Sweet Water all killed, excepting one plant of the last, the leaves of which seemed inclined to rot or mildew, and fell off about midsummer.

Blood's Black and White, of very inferior quality, foxy, and of no use whatever. Cassady, bunches large and compact, being medium to small, nearly white, sweet, and very good. Child's Superb, one small bunch. a white and insipid grape. Cuyahoga, a white grape of good size; quality a little better than the above. Brandywine inferior, bunch very large, of second-rate quality. Baldwin, a small grape, with very good wine qualities. Albino, large white, miserable fox. Elizabeth, a greenish white grape; had but two bunches of fruit; berry and bunch large, sweet, but of no decided flavor.

Wright's Isabella and Christie's Isabella, simply Isabella, are slightly varying, and no better.

Northern Muscadine, large, very compact bunch; fair, but too much of the fox; Mary Ann, very early; bunch large, being medium, oblong, very good, yet foxy. Louisa, almost Isabella, a few days earlier, yet of no more use here than the old Isabella. Lenoir is simply the Herbemont. To Kalon, a few bunches of very large and nearly black grapes, of fine quality, and very good.

I covered no grapes of any kind this fall, determining to throw all my vines upon the ground, with the intention of discarding such as did not prove hardy. A severe winter followed, and every variety except Concord, Clinton, Catawba, Taylor, Blood's Black and White, Franklin, North America, Hartford Prolific, Oporto, Marion, and Kitchen, were mostly destroyed. A small portion of the Catawba escaped being entirely killed, and these were strong old vines.

The next spring I set Rogers's Nos. 1, 2, 4, 9, 15, 19, 22, and 34; Perkins, Norton's Virginia, Maxatawney, Ives's Madeira, Isabella, Iona, Adirondack, Creveling, Underhill's Seedling, Elsinborough, some fine four-year old Dracut Early Amber, and several others claiming a good or local reputation.

Rogers's No. 1 were all from single eyes under glass, and also Iona, Isabella, Adirondack, and Underhill's Seedling. All the grapes were left upon the ground, and a little litter thrown upon them. I felt no uneasiness, as they had a reputation for hardiness. All the other varieties were one-year layers. Rogers's Nos. 1, 4, 19 were killed to the ground, but survived, and made fine growth next season. Perkins, Norton's Virginia, Joe's Mariole, and Dracut Amber were perfectly hardy. Rogers's Nos. 2, 9, 15, 22, and 34, Isabella, Iona, and Adirondack were killed outright; Creveling, Underhill's Seedling, and Elsinborough somewhat damaged. All had received the best of cultivation, and made a good growth, ripening up their wood perfectly.

The experiment on the last year's setting might not be a test sufficient to discard or retain upon its merits, as a portion were *layers* and a part grown under glass from single eyes; yet it *is* a test for grapes grown under glass for open-air culture, and decides materially against the glass-grown vine; and no western man should allow himself to purchase such vines, unless he is an amateur cultivator, who can grow them two or three years in beds, and give them the protection they require to make good plants to set out at three or four years of age, in garden or vineyard.

I know that this position will be unpopular with a majority of those who sell vines; yet I am writing of a costly experience for me for the man *who has to buy vines to set for himself*, and for the benefit of those who cannot afford glass structures, or to wait for fruit from vines that require years of nursing.

A layer from old wood is preferable to any other vine, or, at least, a two-year vine if made from the current year's growth when layered. Cuttings make good vines when cut to two eyes, yet my preference is for layers. A friend in Mis-

souri has been growing under glass single eye vines bought in Illinois, and he is fully convinced that for his State layers are preferable to any other; and I believe a majority of the growers in the west will substantiate the opinion. The people want grape-vines, not little soft-wooded affairs, of which you can put a hundred in your coat-pocket.

In Minnesota, the Concord and Clinton are the only grapes to be fully relied upon. We have seen the Hartford Prolific and Delaware succeeding in the southern part of the State, and they bore full crops. Many others have been tried, but mostly failed. Norton's Virginia and Ives's are under trial there, and I have no doubt but that they will succeed well, having proved hardy the past two seasons. The Delaware has met with poor success at the west, particularly in Nebraska, Illinois, and Missouri. In portions of Iowa it has succeeded well, but in far too limited a space to become popular.

The Concord is *the* grape for all the west, possessing more good qualities and less poor ones, and, though not perfection in flavor, is very good. The decision of the Greeley prize committee has stirred up the ire of the producers of seedlings, men who are flooding the country with grape-vines with fruit of fine color, fine size, fine quality, and *perfection* in flavor, at from $3 to $5 each.

The award of that committee is honorable and fearless, and a benefit to the poor man who can afford but a few grape-vines, and cannot afford to test pet seedlings that *may* succeed for a year or two, and then be swept away in a single season by mildew. The good sense and judgment of this committee are fully supported by four-fifths of the grape-growers in the land.

The intelligent fruit-growers of the west have taken the Concord and placed it at the head of the list for *their* own use in their families and for market, and many of them find it a first-class wine grape. In Nebraska, a few are still holding on to the Delaware; yet, as their patience of *trial* continues, the vines of that variety seem to grow less. The Dracut Amber is a grape without very much quality to recommend it; yet, being entirely hardy and the earliest of any tested, will be grown by many.

For the west, we would say buy the Concord first for the table; if you can afford more, set the Hartford Prolific and Taylor's Bullitt. For wine, plant Ives's and Norton's Virginia, and Clinton, and you will never have cause to regret that you did not buy any larger number of unknown kinds.

The Concord and Hartford Prolific have never shown a diseased berry or a spot of mildew in Nebraska, and we have never heard of any disease in either of them anywhere in the west.

Any improvement with the Concord as the starting-point promises to give us larger fruit, better flavor, and equal hardiness, with thrifty growth, healthfulness, and productiveness, and will be welcomed as a grape worthy of general cultivation.

WINE-MAKING AND VINE CULTURE IN THE MIDDLE STATES.

BY WILLIAM C. LODGE, CLAYMONT, DELAWARE.

WINE has not heretofore been made, in any considerable quantity, in the middle or New England States. The venerable Nicholas Longworth, of Cincinnati, spent a portion of his time, and considerable of his abundant means, in the generous endeavor to demonstrate the practicability of making good wines in the

latitude of 39°, with partial success. I say with partial success, for, however excellent may be the quality of the Longworth wines, the cost of their production should be such as to render them profitable. Regarded, however, as a mere experiment, it may not be proper to take the cost into consideration, as so many difficulties were to be overcome by a beginner in the business in this country, and so much machinery procured from abroad, most of which trouble and expense may be saved to his successors.

Our old-fashioned housewives have tried their hands in the manufacture of wines from blackberries, elderberries, currants, and a variety of fruits and vegetables, from time almost immemorial. But grape wines, of domestic manufacture, were seldom to be met with, on account of the popular opinion, then existing, that it requires greater skill and more experience to make wine of grapes. Such an opinion is now found to be fallacious, for, by careful treatment and a knowledge of the principles of wine-making, a far superior article can be made of grapes, at the same expense and trouble, than can be made from any other fruit.

The difficulty, in this latitude, is simply that the short seasons will not always allow the grapes to mature perfectly. A well-extended season and warm sunshine are necessary to properly mature the grapes and elaborate properties on which depend the successful manufacture of wines of highest excellence.

For wine-making in this section we should cultivate only such grapes as mature early, having in view their wine essentials. It will be better to select the best varieties from a more northern climate, rather than those even superior in quality from a southern locality, as upon the perfect maturity of the grapes depends the quality of the wine, as well as its durability.

The best wines are made from grapes containing, in proper proportions, sugar, water, and acids; and to give them this proportion of constituent matter the most favorable climate and soil are necessary. Even with these advantages, so much depends upon the seasons, and a variety of causes, that the best article cannot always be produced.

The celebrated wines of France and Germany, which constitute standards of excellence throughout the world, are not always made with certainty. The famous vineyards which produce the Steinberg and Johannisburg wines do not come up to their highest standard oftener than once in five or six years, and the grade of their wines is sometimes so low as to be excelled by the best years of other vineyards possessing few or none of their advantages.

We therefore conclude that no locality can be recommended for all seasons, no particular soil for all latitudes, and no single variety of grape for all localities. The variety of grape should be adapted to the soil and climate, and that variety which contains in greatest quantity the essentials for wines in the gathering season should be the grape adopted for its especial locality. The Concord, or other early-maturing variety rich in sugar, would probably give as good wine in the latitude of New York, as the Isabella, or other variety requiring a longer season, would give in the latitude of Richmond, Virginia, all other things being equal.

Yet it must be admitted that, as continuous sunshine and a long season enrich the grape, the chances for successful wine-making are more favorable in the south than in the north.

Knowing, from actual experience, that good wine may be made from native grapes in the middle States, I propose to give the results of my own experiments, conducted through a series of years, without especial regard to the rules laid down by European manufacturers. Indeed, it would not be practicable to follow their plans throughout, inasmuch as their vineyards are quite extensive, their labor procured at a low rate, and the manufacture of their wine conducted on a scale truly grand. The proprietors of small vineyards seldom make up their grapes, but sell them to the large establishments, where the requisite skill and machinery are found for successful manufacture.

Our grapes are often picked from the vines before they acquire ripeness at all, as it is by the color we judge of maturity. Perfection of color does not always indicate maturity, as nature continues her elaboration and refinement of the juices long after the coloring is completed, and even until the grapes shrivel. We pick our grapes in September, or the first week in October. In the same latitude in Germany, the grapes are allowed to hang until frost, or even late in November. The popular opinion with us is, that American grapes are unfit for wine, inasmuch as the quality is so inferior to those of Europe. It is true that we can show no such magnificent berries and clusters as their Chasselas and Hamburg, and many others, but we still have varieties by no means contemptible in appearance, nor deficient in wine-producing properties. Nor can we grow grapes of equal merit in the same degree of latitude. They have advantages of soil, or modifying influences of climate, which are denied us, and their grapes consequently become more perfect in their wine essentials. Nevertheless, we have an abundance of sweet grapes that ripen early, and will acquire all the perfect wine essentials, by hanging late upon the vines, or, in case the weather prove unfavorable, or the birds become so troublesome as not to allow the grapes to hang late, they may be picked earlier, and ripened on straw in well ventilated rooms.

PICKING.

We are accustomed to pick all our grapes at once, particularly those of the same variety, without regard to difference in ripening. In Europe, several pickings are made from the same vine, selecting only those clusters which are fully ripe. The berries ripen unevenly upon the same vine, and in the same cluster. The splendid and expensive Johannisburg cabinet wines, known as Green Seal, Silver Seal, and Gold Seal, are made from the most perfect grapes, selected individually from the ripest and most perfect clusters. The Green Seal is familiar to us, the Silver Seal is sometimes imported into this country, but the superb Gold Seal is practically unknown to us. Seeing the care taken in the selection of the grapes, and the profitable results, in the old countries, where the manufacture of wine has so long been familiar to the people, and where the machinery is almost perfect, we need not be surprised that our sour and unripe grapes, made into wine by inexperienced hands, and by our rude implements, should not equal the better, or even the medium, wines of Europe. Nor is our partial failure, so far, a proof that good wines cannot profitably be made by us, when we bring well-matured grapes, and the proper implements, in combination with skill and experience.

CRUSHING AND PRESSING.

Having selected the grapes, they are picked from the stems, and bruised so as to burst the skins, either by passing through a small mill made for the purpose, or by placing them in a tight clean cask, and pounding them with a wooden pestle; or, as is sometimes practiced in the old countries, by treading them in a vat, with the feet encased in wooden shoes. A sieve is sometimes placed in the bottom of the vat, and, after the treading or bruising is completed, the juice is allowed to drain, without pressing, into vessels set to receive it, and of this juice or "must" is made a wine of the first quality. The mass, composed of the remaining juice, seeds, and skins, is then pressed, and a wine of the secondary quality made of the expressed must. It has been observed that the grapes should be picked from the stems; this, however, is not always necessary, but is the best plan for our grapes, as the stems contain a large proportion of tannic acid, which gives the wine a tart and harsh taste, well dispensed with, inasmuch as the grapes themselves are charged with a full supply of those properties.

FERMENTATION.

I now come to the most critical stage in the process of wine-making, as upon the fermentation depends the quality of the wine, no matter what care may be taken in the selection of the grapes, or the preparation of the must. It is generally preferable to allow fermentation, either partially or fully, to take place before the separation of the skins, as the color resides in the inside of the skins, and is best extracted by the process of fermentation.

When the grapes are pressed immediately after being crushed, the wine will be colorless, even from dark or black grapes, whereas it will assume a light red, a deep or port color, according to the time it is allowed to ferment with the skins. The seeds and skins also impart other qualities, and it is generally conceded that the wine so made will be more durable.

The vessel in which the wine is left to ferment may be either kept continually filled by must of the same age, or by sweetened water, so that the act of fermentation will eject all extraneous matter from the top; or, it may be left without refilling, when the yeast, &c., will settle to the bottom, and the clear liquor may be poured from the settlings. There is generally a difference in the quality of the wines so manufactured, that in which the sediment all remains in the bottom of the vessel usually possessing more body. Much, too, depends upon the temperature which effects the process of fermentation. In cold weather the must ferments so slowly that, when exposed to the air, there is great danger of its becoming sour. Acetic fermentation is caused by long exposure to the air, and the result is vinegar instead of wine. We therefore prefer the fermentation to take place in closed vessels, so as to exclude the air from contact, when practicable. This is done by fitting an air-tight cover, or bung, to the cask, and inserting a siphon, the other end of which is placed in a tub of water, into which is discharged all the fermenting matter.

We may hasten the fermentation by artificial means, so that it may be completed before the must becomes sour at all; but it is liable to after fermentation, and requires care and watchfulness, and is not so durable as when the whole process is slow and perfect. Much, too, depends upon the temperature of the must, for it is this generation of caloric, in the mysterious laboratory of nature, that produces fermentation. Should the weather be such as to warm the must to a proper degree, the fermentation will at once take place, and proceed rapidly to completion, which will greatly lessen the risk of souring.

From well-matured grapes, which have hung upon the vine until their skins become thin and somewhat shrivelled, good wine can be made without any additions whatever. But if the grapes be gathered before the sugar formation takes place, and the refining process is completed, it is best to add sugar before fermentation of the must, and afterwards alcohol, in proportions of from half a pound to three pounds to the gallon, and from a gill to a pint of either alcohol, wine-spirits, or white brandy, according to the maturity of the grapes, or according to their quality. In wine made from perfectly mature grapes, the addition of sugar might be detected by the taste, and the largest amount above named would make a cordial instead of a wine, from the fact that there would not be a proper balance of acid, which is necessary in a good wine; but in the must of unripe grapes the acid already exists in far too great a proportion to the water and saccharine properties. Sugar and water may, therefore, be added with advantage, though the result will be a wine of less durability, and probably of a lower grade. A liquor is sometimes made and sold as wine, without any grape juice in its composition. It is drank by the inexperienced without a suspicion of its true character, and is even preferred to wine of inferior quality.

SPARKLING WINES.

Sparkling wine, known as champagne, is made by preventing the escape of the carbonic acid contained in the grape, and which is, in a great measure, given

out in the ordinary process of fermentation. Sparkling wine may be made from any perfectly-matured sweet grapes, or by the addition of sugar when the grape is deficient in that quality. It is necessary to bottle the wine while in the act of fermentation, so as to imprison, as it were, the carbonic acid gas, and hold it obedient to our call. But here arises a difficulty that cannot be successfully met, without the use of rare and expensive instruments. It is no less than to determine the strength of the gas, so as to know the proper condition for bottling with safety. Many bottles, and much wine, are lost in the manufacture of champagne, and he is considered as quite successful who does not lose one-half his stock.

In my first experiments, most of the wine was lost by the use of demijohns instead of bottles. I now use the strongest pint and quart bottles that can be procured; but still, in warm weather, lose much from the bursting of the bottles, being still deficient in the implements necessary for the successful manufacture. Another great difficulty is to procure bottles adapted to the purpose. In the champagne districts of Europe, bottles of a peculiar shape, and composed of certain safe ingredients, are used exclusively, for it is known that some of the materials used in the manufacture of ordinary glass bottles become dissolved by the wine and affect its taste, or entirely destroy the wine. I select the strongest bottles, fill them so as to leave a vacant space of half inch to an inch between the wine and cork, and then drive the cork with a wooden mallet. The vacant space serves as an air-chamber, into which the carbonic gas given out in fermentation collects in such force as often to force out the cork, or burst the bottle. Or, if these be of sufficient strength to resist the pressure, the gas is forced back into the liquor again, which holds it until brought into contact with the air, by the removal of the cork. As soon as the bottle is opened, and the wine brought in contact with the air, the gas rushes to the surface, causing the foam and sparkle of champagne.

It may be well here to remark that cider treated in the same manner will also foam and sparkle, and resemble the true wine so nearly that it is frequently sold and drank as the genuine article.

Indeed, in this country more cider champagne is used, without a drop of grape juice to redeem it, than the true wine. It is easily detected by a taste accustomed to the genuine champagne, or by a variety of tests, the most simple of which is the smell evolved by sprinkling the liquor upon living coals. Cider treated as champagne is not durable, and seldom keeps well for more than a year. It then becomes flat, loses its transparency and its sparkling character, and often assumes a thick rusty color.

In the manufacture of sparkling wines in the champagne districts grape juice is only a *constituent* of the splendid article sold under the distinctive designations of Green Seal, Silver Seal, and Gold Seal; and even the best judges generally prefer the made-up article to the true champagne.

NATIVE WINES.

Wines manufactured in the middle and New England States have no distinctive character. The color can readily be regulated from a white to a golden or dark wine, but the flavor and other characteristics are dependent upon artificial management, or are merely accidental. Names are given to my wines only after they have settled into their natural condition and assumed their permanent character, when they are named after the foreign wines which they most resemble in taste and color. This I consider an error, encouraged by the fact that domestic wines are too often regarded as inferior in quality to the same grade of foreign wines. Excellence is generally denied where the taste is formed and the judgment controlled by imported wines, which are made strong by additions of alcohol, in order to bear transportation without risk; yet at dinner parties, when

connoisseurs were present, I have smuggled a few bottles of our "home made" among the good foreign brands, with the satisfaction of seeing them generally preferred and almost universally commended. The very important character of BODY is too often lacking in our domestic wines. This results from the use of grapes not fully matured in all their parts, from the addition of water to the mash or must, from the haste in fermentation, and from want of age. Yet in the Bordeaux districts of France water is added at the rate of from fifteen to sixty per cent., while sugar is also added in proportion. In Spain, where the grapes are richer in saccharine matter, water is added without the sugar.

But our grapes are generally so deficient in sugar, and, in consequence, the alcoholic property, that, unless they are fully matured, we find it necessary to enrich the must rather than weaken it, in order to produce a wine equal in all respects to the Bordeaux of France or Malaga of Spain.

BOTTLING AND STORING.

For still wines, so soon as the fermentation has entirely ceased, or when it becomes weak, which may be ascertained by observing that the surface is quiet or is broken by the bursting of an occasional air-bubble, we proceed to draw the clear liquor from the sediment, and place it in another perfectly clean and sweet vessel, and close the bung either by a loose cork, or by placing a clean cloth, folded several times, upon the hole. This is kept in place by a stone or weight laid upon it. The time required before the fermentation is completed varies according to the kind and condition of the grapes and temperature of the weather. In warm weather the first fermentation is usually over in from two to three weeks, while in the cool autumn, after frost sets in, it requires a much longer period.

Much difference of opinion exists as to the best material to use in the construction of vessels in which the must is to be fermented. In the wine districts of Europe large vats made of stone are sometimes used, but wood is still generally preferred, as the wine is thought to ripen better in wood than in any other material. Great care is necessary to procure such kinds of wood as will not impart an unpleasant taste to the wine, as the liquor will imbibe, in process of fermentation, whatever taste exists in the wood. Oak is generally preferred in Europe, but would not answer so well in this country without undergoing a disinfectant process, as it is highly charged with tannic acid, and when brought in combination with that already existing in so great a proportion in our native grapes, it would give the wine a decidedly harsh and disagreeable taste. Ash would answer the purpose better, but stoneware is cheaper, more durable, and less difficult to keep sweet and clean, while it imparts no taste to the wine. A stoneware vessel can be made of any size, and in any shape best adapted to the purpose, or, what is better, we may have two such vessels so constructed that they may be connected by a tube, in which is placed a stop-cock, so that the liquor may be drawn from one to the other as often as necessary, and without exposure to the air. I, however, use but one large stone vessel, and when the first fermentation is over, draw the liquor into large glass vessels or demijohns, covered by a network of oak or willow, and holding about ten gallons each. These glass vessels are as large as can be procured, and answer the purpose where the manufacture is not conducted on a very large scale, but are of insufficient size where the operations are extensive, as the wine acquires more body, and ripens better when kept in moderately large quantities until it is fit for bottling.

Having drawn the wine from the lees, after the first fermentation, it is placed in a dark cellar, and left until the following May, as far removed from atmospheric influences as possible. I have had a stone vault constructed for the purpose of storing wine during the fermentation and afterwards. It is in a hill-side, communicating with the cellar, and is about ten feet under the surface of the ground,

and perfectly dry. On the earthen floor of this vault are placed the casks and large vessels, while the bottles are arranged in cases, and set on shelves above.

About the first week in May, or as soon in the spring as the buds begin to burst and the blossoms appear, a second fermentation commences.

This is weaker than the first, and usually ceases in the course of ten days or two weeks, when the liquor should again be carefully drawn from its sediment into other clean vessels. It now remains undisturbed in its resting-place until October, when it may again be drawn off; or if but little sediment had settled when drawn off in May, it may safely be allowed to remain until the following May, when, if it is perfectly clear and emits diamond-like sparkles in the light as it is poured from one vessel to the other, it may be considered as finished, and is mature at the age of eighteen months. If, however, as is generally the case, sediment is yet found at the bottom, it should be drawn off twice in the second year, and in May or October of the third year, before it is fit for bottling and for use. This latter process insures a better and more durable wine, which will continue to improve for many years.

After the final drawing off, be that in eighteen months or in three years, the wine is put into pint or quart bottles, corked, sealed, and labelled, and then placed in wooden cases holding two dozen each. Before placing the bottles in the cases, lime, in the floury state, is sprinkled on the bottom to the depth of about two inches, and the bottles are then packed in the cases and the interstices filled with the lime even up to the necks of the bottles. The cases are then placed in order upon the shelves, marked with the date of vintage, and left undisturbed until wanted for use.

In bottling sparkling wine this plan has been found safe and economical, since the bursting of a bottle does not endanger its neighbor, as in the usual way of storing.

SOIL AND LOCALITY.

Upon the character of the soil and the locality or "exposure" depends, in a great measure, the quality of the wine. Grapes grown in a damp, rich, heavy soil are larger, more juicy, and the vines more vigorous and productive than those grown in a porous, dry soil; yet the wine made of grapes grown on the dry soil so far surpasses in excellence and durability that made from grapes grown in flat, damp soils, that we readily prefer the quality to the quantity, and plant for wine only on such soils as are well drained by a porous subsoil. A deep, loose, red soil, intermixed with rough stones, (if limestones so much the better,) and a porous subsoil, will produce grapes that will make a wine of highest excellence and greatest durability. The reason is simply that such a soil is retentive of moisture in dry seasons, while it never becomes saturated with water from the rain. The sun heat also penetrates easily to the roots, and thus brings the crop into early and perfect maturity.

The best exposures are those which slope gently toward the southwest, the south, and the west, a southwestern inclination being preferable to all others. With such an exposure and on such a soil corn will ripen from one to three weeks earlier than on flat, heavy land, and the crop will be finer where the conditions are otherwise equal.

I plant my vines in rows from six to eight feet apart and about eight feet distant in the rows, and prune most varieties to a single stake eight feet in height. I also train some varieties of vigorous growth on trellises made of wood, or of wood and wire, allowing the vines to cover the top, while the grapes hang in the shade of the leaves. The bunches grown on the trellises are larger, and the grapes are also finer and more plentiful; but the quality of the wine made from them is inferior to that made from grapes exposed to the sunshine and all atmospheric influences; yet when the vines are grown in porous soil, through which the sun heat readily radiates to the roots, and when the leaves, also, are well exposed to the sun-

shine during the greater part of the day, the fruit grows as rich in sugar, and elaborates almost as perfectly the wine essentials as when the fruit itself receives the sunshine. Indeed, the fierce sun rays are not conducive to either size or quality of the fruit, reflected heat being preferable. The finest grapes, and most perfect in all respects, are grown on vines trained on stone walls, or over roofs, especially flat roofs, made of cement and covered with sand or pebbles, upon rocks, or even upon the ground where the soil is sand or gravel, so as not to retain sufficient moisture to rot the grapes.

PRUNING.

We have arrived at the conclusion, after a series of experiments, that excessive pruning on the European plan will not answer for the middle States of this country. It is true, in the cultivation of grapes for wine, that what is gained in quantity is lost in quality. The ordinary rules for pruning the vine until its third or fourth year, or until bearing commences, hold good here as elsewhere, as they only apply to the vine, and are calculated to give it vigor and endurance; but after it begins to bear, much depends upon the locality, the mode of trellising, and the variety of grape. The native grape, which is preferable for wine, is generally so vigorous that it will perfect more fruit than most of the fine European varieties; yet I have adopted the rule to prune close, in proportion to the size of the bunch and berry, having found that the smaller grapes do not need close pruning in order to enable them to perfect their wine-producing properties. Our finest wines are made from native grapes, when the vine is allowed to ramble at will over trees, and the topmost bunches, most exposed to the influence of the weather, are not only larger, but are richer and more perfect in all respects. Hence I have adopted the plan, whenever practicable, of planting so as to allow the vines perfect freedom to run over trees, and prune only the dead vines or branches, or when the vines become so matted as to exclude the sun and air.

By observing, in substance, the simple rules for the cultivation of the grape and its manufacture into wine, every family possessing a few feet of soil may grow their vines and enjoy the luxury of good grapes, and a better wine than can be purchased without large cost. Root room is nearly all the vine requires, as it will wander independently over trees, fences, walls, or sheds, crowning with beauty all it touches, shielding dwellings from the effect of poisonous gases, and furnishing a luxury in its delicious fruit, and a comfort and medicine in its wine.

BOTANY AND AGRICULTURE OF THE ROCKY MOUNTAIN BASINS.

BY R. O. THOMPSON, NURSERY HILL, NEBRASKA.

It is not my intention in this paper to treat of the vast mineral, pastoral, agricultural and horticultural resources of all that vast and varied country west of the Sierra Nevadas. California, Nevada, and Oregon have been so far developed that they have passed into history, setting all doubts at rest as to their future resources or ability to support and render prosperous and happy the millions who may yet till their soil and delve in their mines.

It is but a few years since that gold was found near Pike's Peak, in Colorado.

The whole east, north, south, and west were fully aroused. Excitement ran high. Thousands and thousands left comfortable homes to become at once possessed of immense wealth. Very few knew or stopped to inquire the needs and wants of such a journey, or the supplies of food and clothing necessary to *live* upon while in the land of gold.

Cities were commenced and machinery was set in motion to crush and separate the golden ore from the granite rock. All the supplies to feed and clothe this busy multitude were transported across vast plains hundreds of miles. The question was soon presented to the minds of the agricultural classes who had gone there, "Can we not produce many of the necessaries of life in the rich soil at the base of these mountains?" Wheat, oats, barley, potatoes, onions, and many kinds of vegetables were planted and found to produce abundantly. The soil is capable of producing almost every agricultural product, though the season is too short for Indian corn. It is probable, however, that certain early and prolific varieties will be successfully introduced. Some of the largest onions and potatoes I ever saw were grown near Denver City. Men having located there for business purposes, finding a pure and healthful climate, determined to make their homes amid the eternal hills. Their families were accordingly removed thither, and with them went shrubs, bulbs, herbaceous plants, grapes, currants, and other varieties of small fruits, all of which were cultivated with success. The apple, peach, pear, plum, and cherry have gone there for trial. A few may succeed, but many will fail from various causes, principally from the limited knowledge of the settlers of locality, varieties, and seasons, as well as from the want of care and judgment in fruit culture generally.

Grape culture may be successfully carried on in certain favored localities in Colorado, when varieties like the Concord, Clinton, and Delaware are planted; yet I am satisfied that the great basins of Utah and New Mexico are much more naturally the home of the grape.

Neither is Colorado destitute of wild fruits, which, in the absence of cultivated kinds, are sought after and seem very palatable. *Rubus triflorus*, a form of *R. occidentalis*, black raspberry, and *R. deliciosus* are found here, the latter a fine fruit of peculiar flavor. *Prunus chicasa* and several other wild plums are met with, bearing fruit that is quite refreshing. Also *Ribes lacustre*, or swamp gooseberry, and two other varieties, neither of much value as fruit, and *R. aureum*, or golden currant, *R. floridum*, (but not the same found in Kentucky,) fruit large, musky, but palatable. It is distinct from the Utah varieties. I will notice a few of the flowering plants and grasses of the plains, passing into the mountains over the range into South Park and thence into New Mexico. The order SCROPHULARIACEÆ is a very interesting one in this latitude. The PENTSTEMONS comprise a large number of varieties and are worthy of much attention. *P. albidus* is a fine white-flowered species, and *P. grandiflorum*, on Platte river, Nebraska; also found on the Pecos river, New Mexico; *P. cobæa*, found in Nebraska on gravelly banks of Nemaha and two localities in New Mexico. There are two forms of *P. acuminatus*, one with long narrow leaves, the other broad and short. *P. humilis* is a fine strong plant; *P. Hallii*, with a superb blue flower, a small species, but very showy; *P. glaber*, *P. procerus*, *P. glaucus*, *P. gracilis*, with blue flowers, two to three feet high; *P. barbatus* and *P. imbertis;* from *P. barbatus*, a distinct and showy form, with deep brilliant carmine flowers. Two other forms of this are found in New Mexico and Utah. I hope to see this class of plants come into general cultivation, as they are all desirable and showy, and the greater part of them hardy.

Several forms of *Mimulus* are met with, among them *M. rubellus*, *M. luteus* and *M. floribundus; Pectis angustifolia*, growing along streams or hard soils, a low plant, spreading out into large tufts, entirely covered with brilliant yellow flowers.

Among *Orchidaceæ* are *Spiranthes gracilis*, *S. cernua*, and a variety with deep

yellow flowers of very distinct form. *Platanthera obtusata*, and three very showy forms of *Cypripedium*, or lady's slipper, *Delphinium Menziesii*, *D. elatum*, *D. azureum* and *D. virescens*, all showy and hardy, the latter with white flowers tipped with green; *Lupinus ornatus*, *L. aridus* and *L. polyphyllus;* several *Aquilegias* are found; *A. cæruleas* and a doubled white-flowered form with very long anthers; a number of forms of *A. vulgaris* are found in Utah, some of them very desirable.

Of *Astragalus* a large number of species appear; several of them are quite showy and ornamental.

Among *Asters* are found *A. adscendens*, *A. glacialis*, *A. integrifolius*, and a number of other varieties.

Of *Œnothera*, a large number of varieties, many of them showy and worthy of cultivation.

Of the *Gramineæ*, the whole country, from the Missouri river westward, is particularly rich in this order. *Festuca scabrella*, the celebrated 'bunch grass,' well known to all emigrants as *bunch grass*, or *buffalo grass*, is perhaps the most valuable. It extends over a wide extent of country, is the most nutritious grass to be found, and when seemingly dead, and to all appearance worthless, cattle, mules, sheep and horses will thrive upon it without any grain whatever. The hot sun and dry atmosphere of much of this country turn this grass into the best of standing hay. Stock is herded upon it throughout the entire winter, and in spring is as fat as cattle in the eastern States that have been grain-fed and stabled. Another form of this grass, found in New Mexico, has wider tufts, literally covering the ground, and is full as nutritious as *F. scabrella*. Large herds of cattle and sheep are driven there to be fattened upon it and then driven to market in California. I have a friend here to whom I furnished seed, and also learn that it has been sent to Illinois to be tested as a pasture grass. I should be pleased to see this grass introduced throughout the States, and particularly in the south, where stock could be wintered upon it with one-fourth the expense that it requires with other grasses or grain. I believe it will adapt itself to every portion of our country, as it now extends over such a varied region. Seed of this, as well as some others believed to be valuable for meadow and pasturage, as soon as sufficient seed is grown, shall be sent to the department for distribution.

Festuca ovina, *Poa andina*, *P. arctica*, and several mixed forms of the *Poa*, are met with; also two forms of *Sporobolus*, a wiry tough grass; also, *S. asperifolius*, *Muhlenbergia gracilis*, *M. pungens*, and *M. sobolifera*.

Calamagrostis sylvatica and *C. coarctata* are very valuable kinds for hay.

Stipa viridula, *S. juncea*, and *Oryzopsis asperifolia*, the latter remaining green throughout the winter; stock feed upon it, and deer, elk, and antelope, when nearly covered with snow; seed almost as large as grains of wheat; is called "mountain rice," but I have found it in many low valleys, along small streams in Nebraska.

Trisetum purpuraceus, *Tricuspis purpurea*, and a variety of the last with white spikelets; another with brown spikelets.

Koeleria cristata, *Glyceria pauciflora*, *Brizophyrum spicatum*, growing about alkaline and saline marshes.

Elymus condensatus and *E. Canadensis*, with a kernel much resembling rye.

Leptochloa fascicularis, *Spartina junciformis* and *S. cynosuroides*, both growing on marshy land.

Bouteloua oligostachya, and one near *B. hirsuta*, on very dry sandy soils.

Andropogon Jamesii, *Muna squarrosa* and *Aira cæspitosa* and *A. arctica*.

Many of these are found extending into New Mexico and Utah, others in Arizona and northern Texas.

The grasses of Nebraska and westward will yet occupy a prominent place with the farmers and stock-growers of our country. The most nutritious hay made is to be found in these western grasses, and horses and mules, if furnished

with timothy hay and this wild prairie hay at the same time, will eat the latter carefully up before commencing the first.

The plant *Silphium laciniatum*, (polar or rosin plant,) and *S. terebinthinaceum*, growing among these grasses, possess great medicinal qualities. Horses fed upon hay, with these intermixed, are never known to have the heaves. Cattle, sheep, mules, and horses are extremely fond of the heads of these plants while green as well as when mixed with hay. The pure white resinous gum which they contain performs radical cures in all bronchial cases.

The grasses of New Mexico, Arizona, and of northern and western Texas, form a large and interesting class. Many enumerated as belonging to Colorado and Nebraska here again present themselves.

Festuca tenella, F. microstachys and *F. scabrella*, the valuable "bunch grass," here again abounds over a large section of country. A variety of *F. scabrella* is noticed in New Mexico with very wide leaves, and differing materially from the first, as this retains its lower leaves green throughout the year.

Here are found *Poa annua*, a form of *P. compressa*, and *P. aranifera*, and numerous others.

Paspalum vaginatum, P. sericeum and *Panicum pauciflorum* are found on elevations along streams.

Pennisetum viride and *Uniola spicata* are ornamental species.

Phalaris angusta and *P. arundinacea* grow high upon the mountain streams.

Eragrostis Purshii, E. oxylepis, and a variety of the latter, with very large, drooping spikes.

Bromus ciliatus, Lepturus paniculatus, and *Tricuspis pulchella*, the latter a small, fine grass growing along streams, forming a dense silky carpet of verdure.

Of *Panicum* there are *P. obtusum, P. sanguinale*, and *P. virgatum*, generally on the banks of streams.

Sitanion elymoides and a species found high upon the Pecos.

Vilfa tricholepis, and *Muhlenbergia gracillimea* are found on high elevations.

Chloris verticillata, C. alba, the former making most excellent hay.

Of *Trifolium, T. involucratum*, and other forms appear that have evidently been introduced many years ago by the Jesuits.

Of *Juncaceæ*, or rushes, and *Cyperaceæ*, the sedges, there are quite a number of species, of very little interest, except in a botanical way. Many more species of grasses exist that render this country a truly pastoral one. In some sections water is scarce, away from the mountain streams; yet this trouble will be obviated when it begins to be settled by an industrious and energetic people.

This whole country is peculiarly rich and full of an instructive and attractive flora. Here again the *Pentstemon*, with many beautiful species, attracts the attention of the botanist. *P. gracilis* and *P. barbatus* are very showy plants here, assuming more robust forms than further north. Three varieties of *P. barbatus* are here met with. *P. imbertis* is a most gorgeous flower; *P. spectabilis* and *P. Fendlerii* are desirable; *P. dasyphyllus*, a species with blue flowers; *P. albidus, P. pubescens, P. Cobæa*, and others.

Of *Aquilegias, A. leptocera, A. Canadensis*, and two forms of the long-spurred California varieties; one much like *A. cærulea*, of California and Utah; all showy and desirable hardy plants.

Delphinium azureum, here with wider leaves than in Nebraska specimens; *D. scopulorum* and *D. coccineum*, the last a most showy and superb variety, with large scarlet flowers and long leaves.

Clematis viorna, C. lasiantha, rare and showy; *C. Drummondii* and *C. ligusticæfolia*, and *C. Pitcheri* are found in the extreme south, and one or two others, with small leaves almost entire.

A large number of species of *Ranunculus* are found here; among them *R. affinis, R. divaricatus*, and a form of *R. repens*, with some twenty other species and sub-species.

Of *Cleomes* we find *C. Sonoræ*, *C. integrifolia*, and *Polanisia trachysperma*, all quite showy annuals.

In *Lupinus* are *L. agrophyllus*, *L. pusillus*, *L. Texensis*, and *L. sparsiflorus*.

There are also many interesting varieties of *Lathyrus*, *Astragalus*, *Dalea*, *Artemisia*, *Actinella*, *Gaillardia*, *Cassia*, *Mimosa*, *Acacia*, *Œnothera*—of this a large number of species; *Saxifraga*, *Pectis*, *Eupatorium*; a great number of forms and species of *Asters*, *Mimulus*, *Salvias*, *Phacelia*; and in *Phloxes*, a number of showy varieties; a large number of *Gilias*, one of *G. longiflora* blooming eight months in the year; *Convolvulus*, *Ipomea*, *Physalis*, *Asclepias*, in four forms, and one *(A. tuberosa)* found much further north and west; twelve species of *Euphorbia* are found; *Agaves*, *Violas*, *Calliopsis*, four species of *Lobelias*, and a variety of *L. Texensis*, with small flowers.

Of *Verbenas*, *V. hastata*, *V. aubletia*, *V. canescens*, and several hybrid forms are found. *V. bracteosa* is also found here, and can be traced from the head waters of the Yellowstone to St. Louis.

Abronia mellifera, *A. cycloptera*, and *A. fragrans*, the latter with very large heads of snow-white flowers, rising on stems ten inches high, with a habit like the Verbena, and the sweetest fragrance of any plant I ever knew.

Perhaps the *Cactaceæ* of this whole region may be considered its most interesting botanical feature. In the extreme southern portions, and on the Gila, the *Cereus giganteus* is found. This *Cereus* assumes the immense height of thirty to forty feet, and is a source of food to the natives; from the fruit a very palatable molasses is made. The genera as well as species are so hard to determine, we shall not attempt it. A large number of species exists from the head waters of the Missouri river to our southern boundary, growing on mountain tops, in valleys, in the sands of the desert, and on the vast arid plains, where nothing save this and "sage brush" is found. Species are found full grown, from three inches to forty feet; some, in their thorny or spiny exterior, are repulsive forms of vegetation; many others produce very showy and interesting flowers. No work would be more interesting to the botanist than a complete description and classification of the *Cactaceæ* of North America.

Of wild fruits of this region are *Berberis trifoliatus*, *B. repens*, and *B. Fendlerii*, all found in the mountains. *B. Frémontii* is a very showy species, growing six feet high, with clusters of blue fruit.

Prunus Americana, *P. Chicasa*, and *P. gracilis*, the latter in open grounds.

Prunus subcordata and *P. dermissa* are met with further south, and in northern Texas.

Cerasus multiflora, *C. Virginiana*, and *C. prostrata*; the latter, in sandy places in the northern portions, is very dwarf in growth, spreading out on the ground like juniper, and bears a most delicious fruit which is sought with great avidity by the Indians. This is not the same species of "sand cherry" or *C. pumila* found in Utah and on the shores of Lake Huron.

Rubus Mexicanus, *R. leucordermis*, *R. Menziessii*, and two other species are met with.

Ribes oxyacanthoides, *R. niveum*, and a species with deep, shiny black fruit are found above Santa Fé.

Morus rubra is met with all through the southern portion, and a variety like *M. niger* in the extreme north, the fruit, however, not seen.

The grape is here represented by *Vitis rupestris*, *V. æstivalis*, and *V. bipinnata*. On the Rio Grande, on many of the haciendas, are found many kinds of the old mission grape of California, which are of undoubted foreign origin.

Several kinds of these grapes are in cultivation in the great valley or basin of Utah. They thrive there remarkably well, producing fine crops, but not with the delicious flavor of the same varieties grown in New Mexico and Arizona. Several of them, grown from cuttings taken from the garden of Brigham Young, were tested in Nebraska; yet all but one proved entirely worthless, being so

tender that they would not stand the same exposure as Canadian Chief and Wilmington. The one found to be hardy was evidently of the species *V. vulpina.* New Mexico may be considered a mountainous country; in fact, it is almost shut in from north, east, and northwest by a vast chain of mountains; yet an erroneous opinion has gone abroad that it is a country with only vast mountains, valleys of sand, and large arid plains, all destitute of vegetation and timber, only fit for the home of the savage and wild beasts. This is not the case. The most cultivatable portions lie along the Rio Grande, Upper Pecos, Canadian, and Rio Mora rivers; yet there are many square miles of the most productive lands west of the Rio Grande, and in other portions of the Territory.

The great valley of New Mexico bordering the Rio Grande river runs nearly north and south, and at the southern line is intersected by table lands and mountains from the east and southeast, presenting one of the most sheltered locations in the world. The soil is generally light, with considerable mixture of sand, but along the streams there are deposits of deep rich soil brought from the mountains, year after year, by the action of the water. The soil seems to possess the elements required to produce wheat, oats, rye, barley, beans, and all kinds of vegetables to perfection.

The timber of this Territory consists of pine, spruce, cedar, oak, ash, cottonwood, and some others. High up on the mountains the conifers assume lofty proportions; on the low plains and bottoms the low scraggy mesquit, a species of acacia, abounds. In the middle and southern portions snow never falls to exceed a few inches, in and many winters none at all, and never remains but a few hours at a time. On the high mountain ranges snow may be found throughout the year. The deep snows falling at the head waters of the Rio Grande, Canadian, and Pecos, melting away each spring, supply the country below with an abundance of pure water. Irrigation is carried on here quite extensively, yet many improvements can be made for a more perfect supply of water to be used in agriculture. The rich deposits of soil brought upon the irrigated land impart a fertility to be secured in no other way. The continual process of thus enriching the land is worth all the cost of irrigation.

The bottom lands are undoubtedly best for all agricultural purposes, are very easily irrigated, and are also entirely sheltered and protected. The table lands approaching the mountains being covered with the best of pasturage, will be devoted to the production and maintenance of large herds of sheep, cattle, and mules.

The immense beds of gypsum, iron, copper, lead, silver, coal, and other minerals, when fully developed, will be a great and lasting source of wealth to the Territory. The mining carried on here is of the most rude and cheap description, but producing very remunerating results.

Could the general government render safe the lives and property of the settler, and at the same time open up a railroad to the States, at an early day New Mexico would become the greatest wool-producing country in the world. The expense of raising, subsisting, and tending the flocks and delivery of the product at a railroad station there, would not be *one-fifth* of the cost of the same product ready for market in Iowa or Vermont. Here is a sweet nutritious grass for the herds to feed upon every month in the year. Shepherds live at a very nominal figure, and no sheds are required to protect them at any season.

The same outlet which a railroad would insure would open up the cotton-growing interests of New Mexico and Utah. Cotton can here be grown at a fair profit, and with certainty that when planted and cultivated it would be a sure crop. The danger of loss by frost would never be felt here. Perhaps as fine cotton as was ever grown anywhere has been grown in Washington county, Utah, and in New Mexico.

Good crops of corn are grown in some sections, yet it is more a country for

TETOFSKY.

small grain and vegetables. Potatoes do not succeed as well in the southern part or upon the bottom lands as they do in the cooler portions and in the mountain valleys. The sweet potato and yam do well, and produce large crops of the very best quality.

As a fruit country, shut in by mountains from cold winds and sudden changes, when fully tested, I believe it will be found to have no equal anywhere on the broad face of our continent. Many varieties of fruits have been grown here for years, yet most of them are very common. The grape may be considered as much at home here as in Germany, Italy, or California; in fact, wine is made superior to any of the brands from California we have tested in the past two years. This wine is very imperfectly manufactured, yet with age it will command a higher price in the markets of the world than any importation from Europe.

Most delicious grapes are grown here, double the size of the finest Black Hamburg of the green-houses of the States, with a flavor and richness not found in those grown under glass; and these are produced with very little labor, with no danger of a loss of the crop by frost, mildew, or any disease whatever. There are some vineyards of limited extent in the valley of the Rio Grande, owned by the Spanish population, and the Pecos Indians are engaged in the grape culture on a small scale. The varieties seem to be those of the *Vitis vinifera;* yet they are all seedlings, or propagated from seedlings, as none of them appear to be the same with any of our foreign grapes now named.

POPULAR VARIETIES OF HARDY FRUIT.

BY F. R. ELLIOTT, CLEVELAND, OHIO.

THE following is a continuation of articles descriptive of fruits published in the reports of the Department of Agriculture for 1862, 1863, 1864, and 1865:

APPLES.

Synonym.—Tetofsky.

Season.—Fourth of July.

Fruit.—Size, medium; form, roundish, slightly conical; color, light-yellow ground, striped and splashed with red, covered with a beautiful white bloom; stem, short, stout; cavity, deep, furrowed; calyx, rather large, long segments; basin, abrupt, deep, irregular, furrowed or ribbed; flesh, white, tender, sprightly, juicy, slightly acid or sharp sub-acid, with a peculiar pleasant aromatic taste; core, small, fleshy; seeds, plump, light-brown; season, early to last of July.

Tree.—Very stout and upright in growth, with a peculiar light-reddish yellow wood, very broad, large leaves, of a light-green, altogether making the tree distinct and prominent, in so much that once seen and known it would always be remembered.

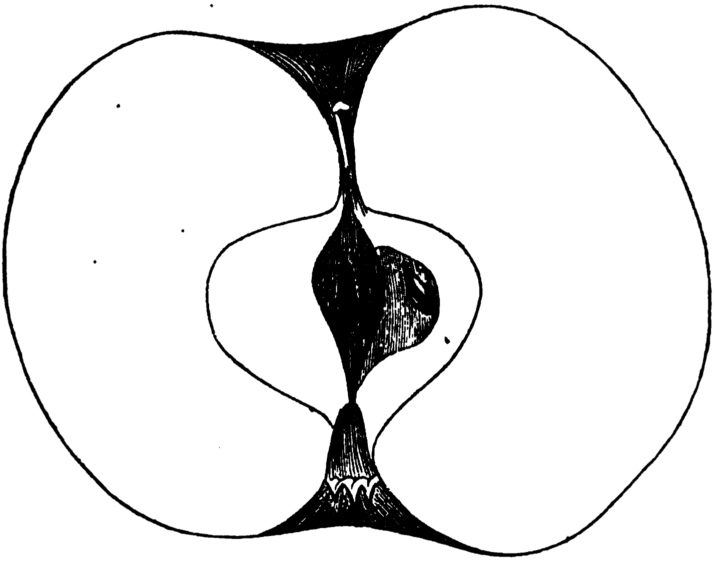
The fruit of this variety, like that of the Red Astrachan or Duchess of Oldenburg, is not of the highest excellence; but there are many sections of our great country where even the apple is a delicate tree, and it is desirable to introduce such as will prove entirely hardy. The Tetofsky is perfectly hardy as a tree, and its fruit quite handsome, produced abundantly, and commanding ready sale in market. As a table fruit, when well ripened, its acid is mellowed, and most

people, after once eating, relish it very much, while for cooking purposes it is superior.

MYERS'S NONPAREIL.

Synonyms.—Ohio Nonpareil.—Cattall apple.

Fruit.—Size, large; form, roundish flattened; color, red and yellow marbled and splashed, and with many scattered gray dots; stem, short to medium, small; cavity, regular, open; calyx, partially open; basin, medium depth, smooth and regular; flesh, yellowish white, juicy, rich, tender, mild, sub-acid; core, regular, partially open; seeds abundant, plump and full; season, last of September to early December.

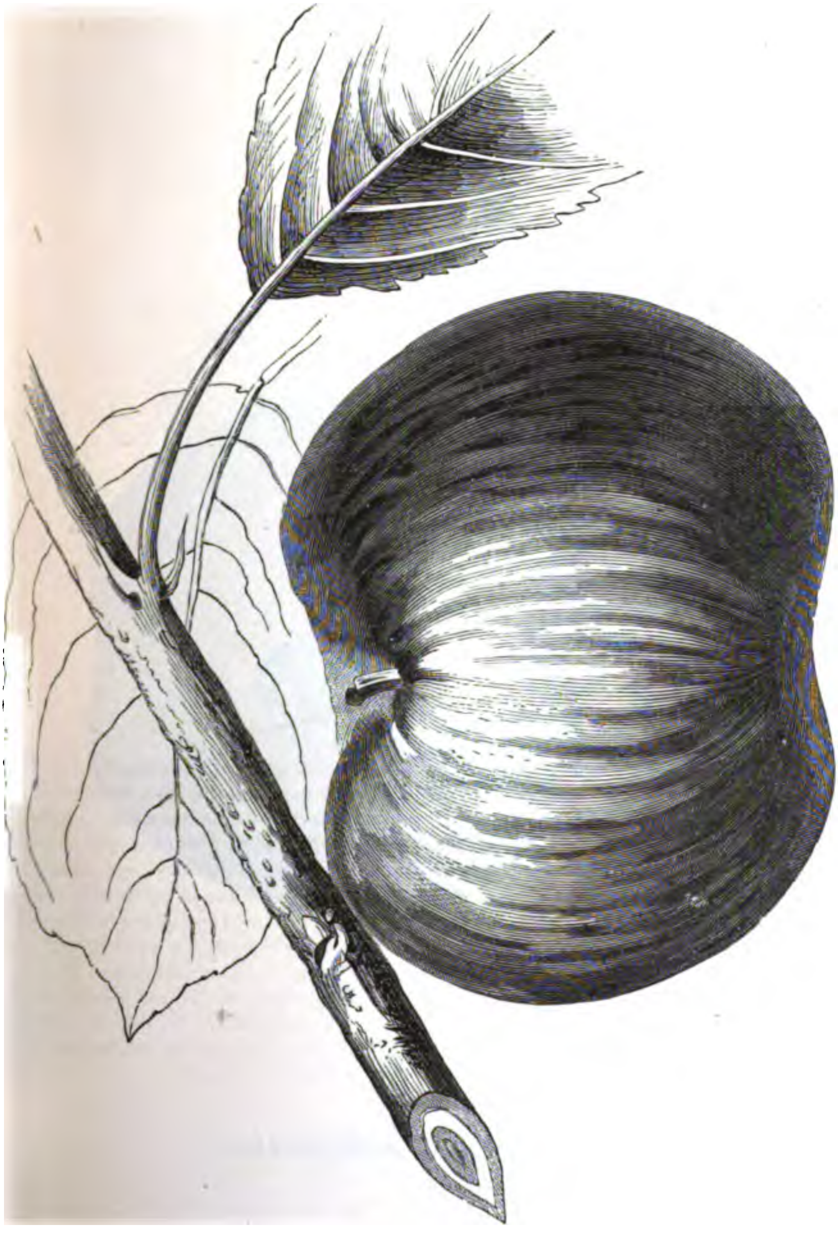


Tree.—A strong, stout, rather spreading open grower, producing its fruit evenly over the whole; leaves, large and broad; wood, stout, and buds round.

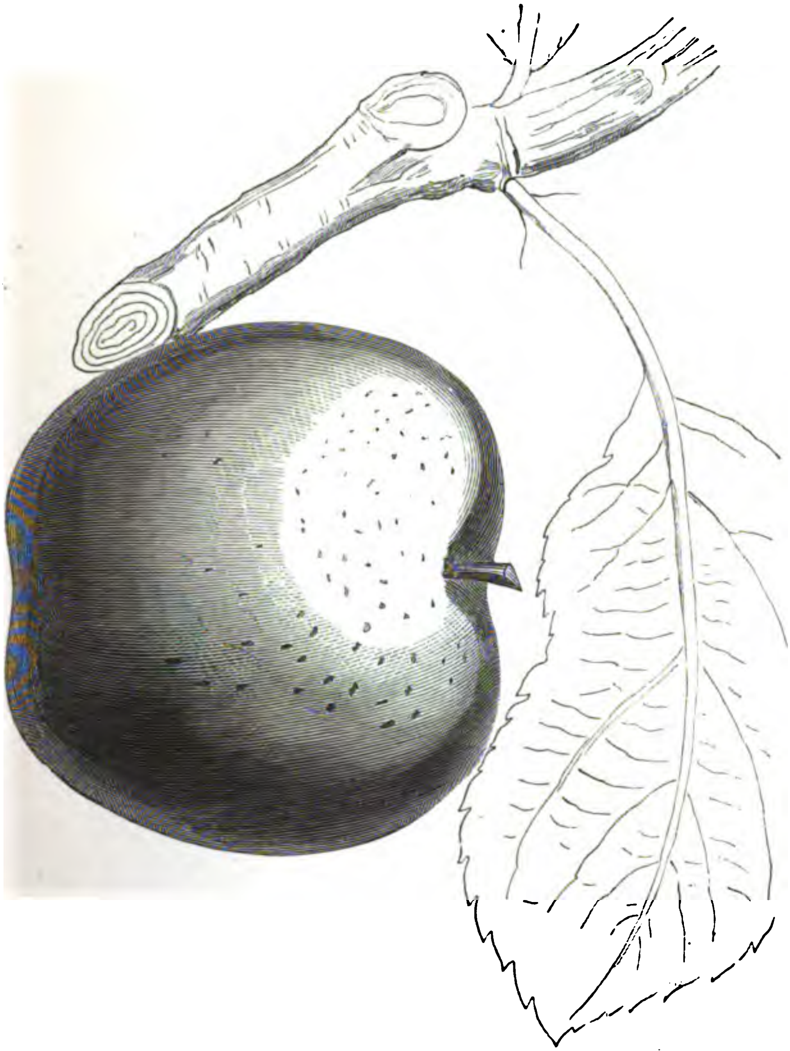
I first saw and described this fruit in 1847, and from its superior quality, as nonpareil gave the height of character to English apples, I named this the Ohio Nonpareil; subsequently it was found that it had been cultivated and disseminated by a Mr. Myers as Myers's apple, and I therefore changed my prefix, calling it, as it is now generally known, the Myers Nonpareil. Its history is somewhat obscure, the original tree, over fifty years old, claiming to be upon lands of a Mr. Bowman, in Massillon, Ohio, while Mr. Myers, of New Lisbon, knows of it from a tree in his father's orchard. It is a fruit, however, of surpassing excellence, and as it cannot be identified with any known sort, it is fair to presume it distinct. It has been pretty generally distributed, and so far proves perfectly hardy in all climates, and yields a fruit that for table or market has few equals.

GRIMES'S GOLDEN PIPPIN.

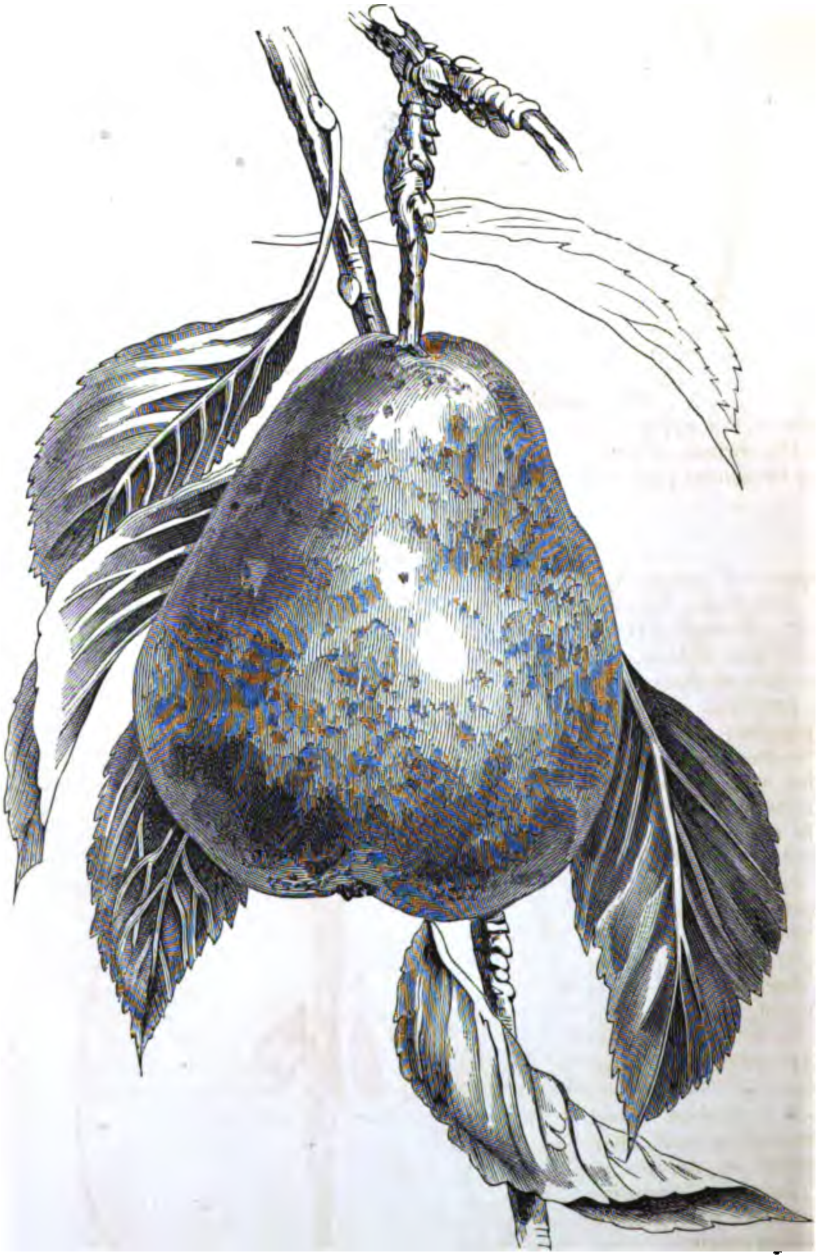
Fruit.—Size, form, roundish, sometimes slightly oblong, and occasionally angular; color, rich golden yellow, smooth, occasional traces of russet, and many minute yellow dots; stem, rather long, slender; cavity, open, regular; calyx, large, generally open; basin, deep, abrupt, waved; flesh, yellow, breaking, crisp, fine grained, juicy, sub-acid, with a peculiar, sprightly, aromatic, pleasant flavor; core, small; seeds, brown; season, December to March.



MYERS'S NONPAREIL.

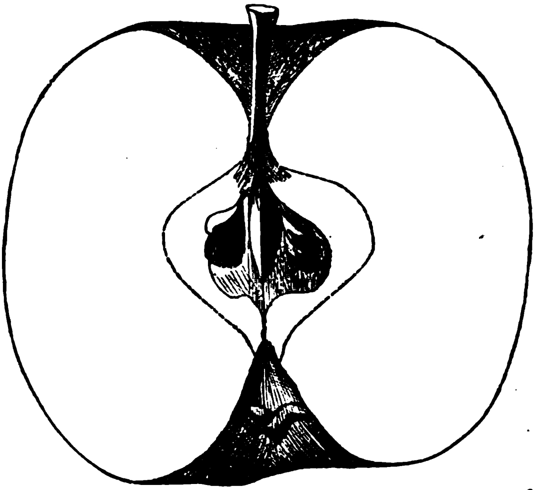


GRIMES'S GOLDEN PIPPIN.



DOYENNE D'ALENCON.

Tree.—Strong, stout, dark shoots, upright, spreading in form, very hardy and healthy, producing annual crops of fruit evenly distributed over its whole surface.



The origin of this apple is traced to an orchard of seedlings in Brooke county, Virginia, the owners of which state that the original tree has never failed of producing its annual crop of fruit.

PEARS.

DOYENNE D'ALENÇON.

Synonyms.—Doyenne Gris d'Hiver Nouveau, Doyenne Marbre, St. Michael d'Hiver, Doyenne d'Hiver d'Alençon.

Fruit.—Size, medium; form, obovate, pyriform, sometimes slightly angular; color, a pale dull yellow-green ground, ruddy in the sun, dotted and speckled over with many brown russet dots and specks; stem, short, stout, set without depression; calyx, medium, with rather erect segments; basin, broad, irregular; core, medium; seeds, large, dark-brown, long pointed; flesh, whitish, rather coarse grained, melting, juicy, vinous, a little astringent unless well ripened; season, January to May.

Tree.—A vigorous, erect grower, succeeding well when worked either on quinces or pear stock, forming a handsome open tree, and very productive. It is of foreign origin.

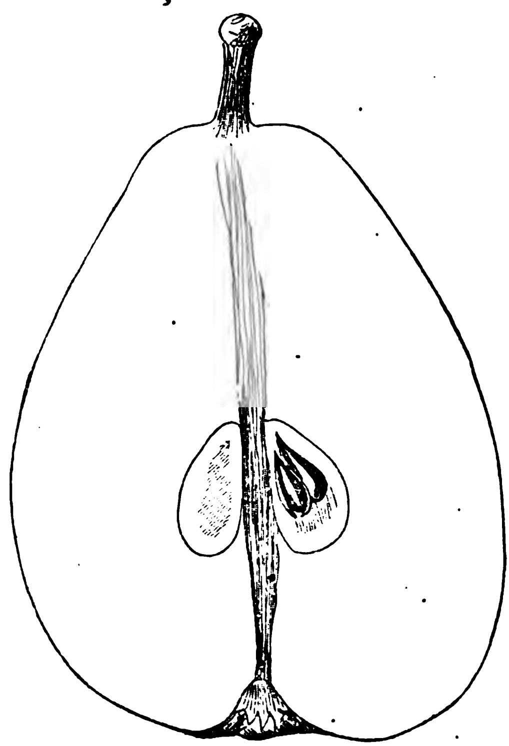
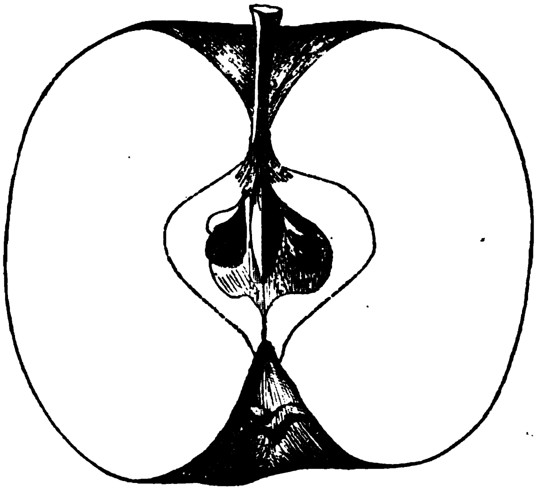


PLATE V.

DOYENNE D'ALENCON.

Tree.—Strong, stout, dark shoots, upright, spreading in form, very hardy and healthy, producing annual crops of fruit evenly distributed over its whole surface.



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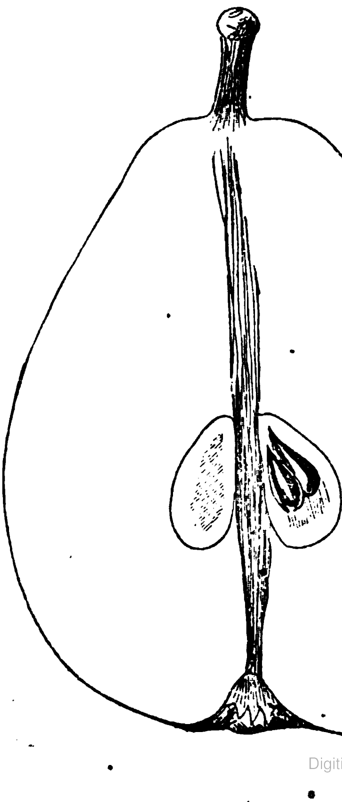
PEARS.

DOYENNE D'ALENÇON.



Synonyms.—Doyenne Gris d'Hiver Nouveau, Doyenne Marbre, St. Michael d'Hiver, Doyenne d'Hiver d'Alençon.

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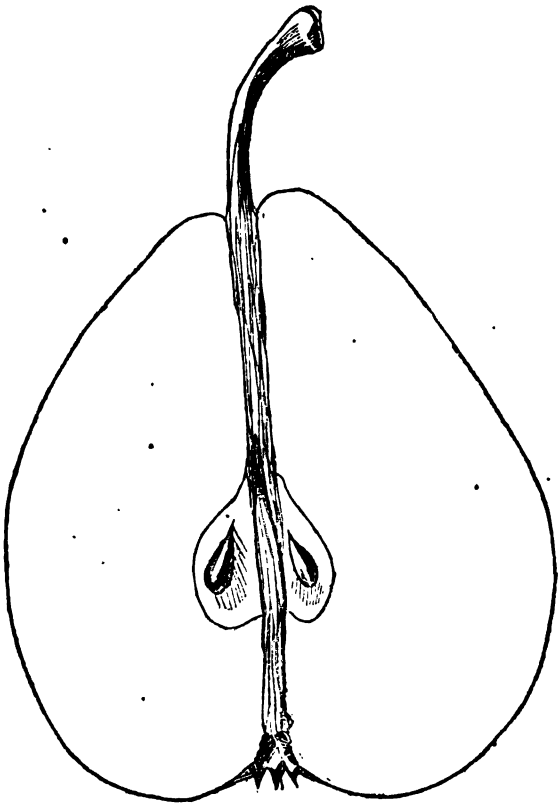
Tree.—A vigorous, erect grower, succeeding well when worked either on quinces or pear stock, forming a handsome open tree, and very productive. It is of foreign origin.

HOWELL.

Fruit.—Size, medium to large; form, obovate, pyramidal, very regular; color, greenish, becoming pale, lemon-yellow or straw color at maturity, many small russet dots, and on the sunny side a faint blush, sometimes deepening into a clear red cheek; stem, about one and one-quarter inch long, curved, moderately stout and inverted without depression; calyx, open in a shallow, smooth, regular basin; core, small; seeds, round, oval, plump; flesh, white, fine grained, juicy, melting, sweet, and pleasantly perfumed; season, September.



Tree.—An upright, vigorous grower, with roundish, broad, oval foliage, an early bearer on the pear stock, and succeeding among the best when worked on quince.

This fruit originated in 1829, in the garden of Thomas Howell, deceased, of New Haven, Connecticut, from seed of a hard winter pear, which had, growing on one side of it, a summer Bon Chrêtien, and on the other a White Doyenne.

DANA'S HOVEY.

Fruit.—Size, small; form, obovate, slightly pyriform; color, rich yellow, mostly overspread with a light thin russet, sometimes deepening into a rich cinnamon russet; stem, medium, one side often a little more depressed than the other; basin, shallow; calyx, with long narrow segments, partially open; core, small; seeds, dark-brown; flesh, buttery, melting, juicy, rich, with a sweet and high aromatic flavor that is especially grateful to the palate; season, December.

Tree.—A healthy, vigorous, upright grower, with strong stout shoots, fruiting early on the pear root. Originated by Mr. Francis Dana, of Roxbury, Massachusetts, and although but recently sent out, there is every reason to believe it a tree and fruit suited to autumn-planting in all parts of the States.

CHERRIES.

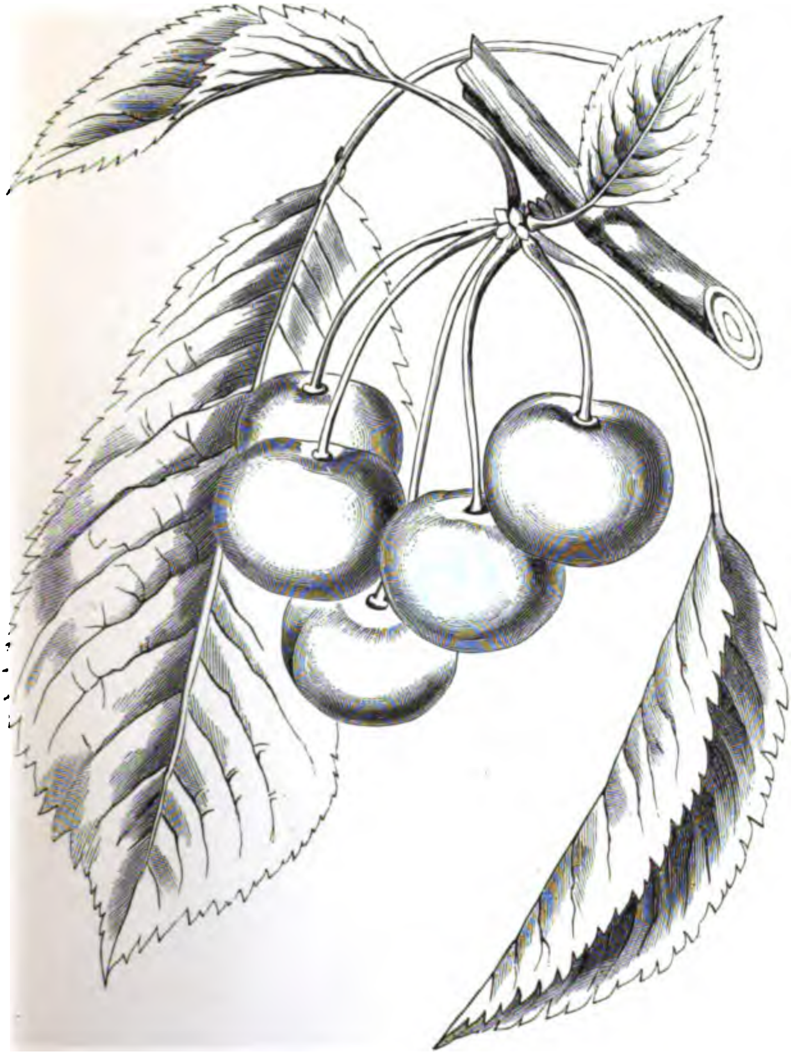
GOVERNOR WOOD.

Fruit.—Size, large; form, roundish heart-shape; color, rich light-yellow, mottled or marbled with a beautiful carmine flesh, and when grown fully exposed to the sun it becomes a clear rich red; suture, half round, followed on the opposite side by a dark line; flesh, light pale yellow, with radiating lines; transverse,

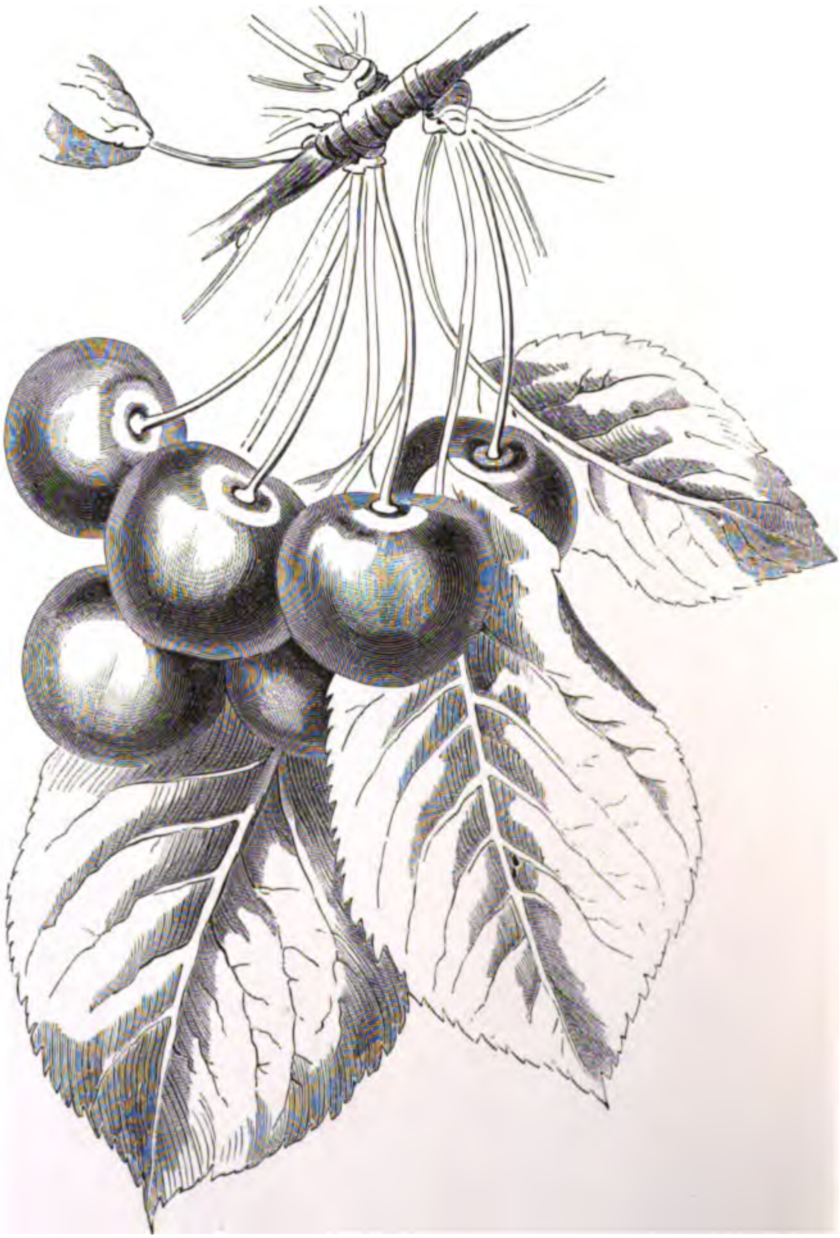
HOWELL.

DANA'S HOVEY.

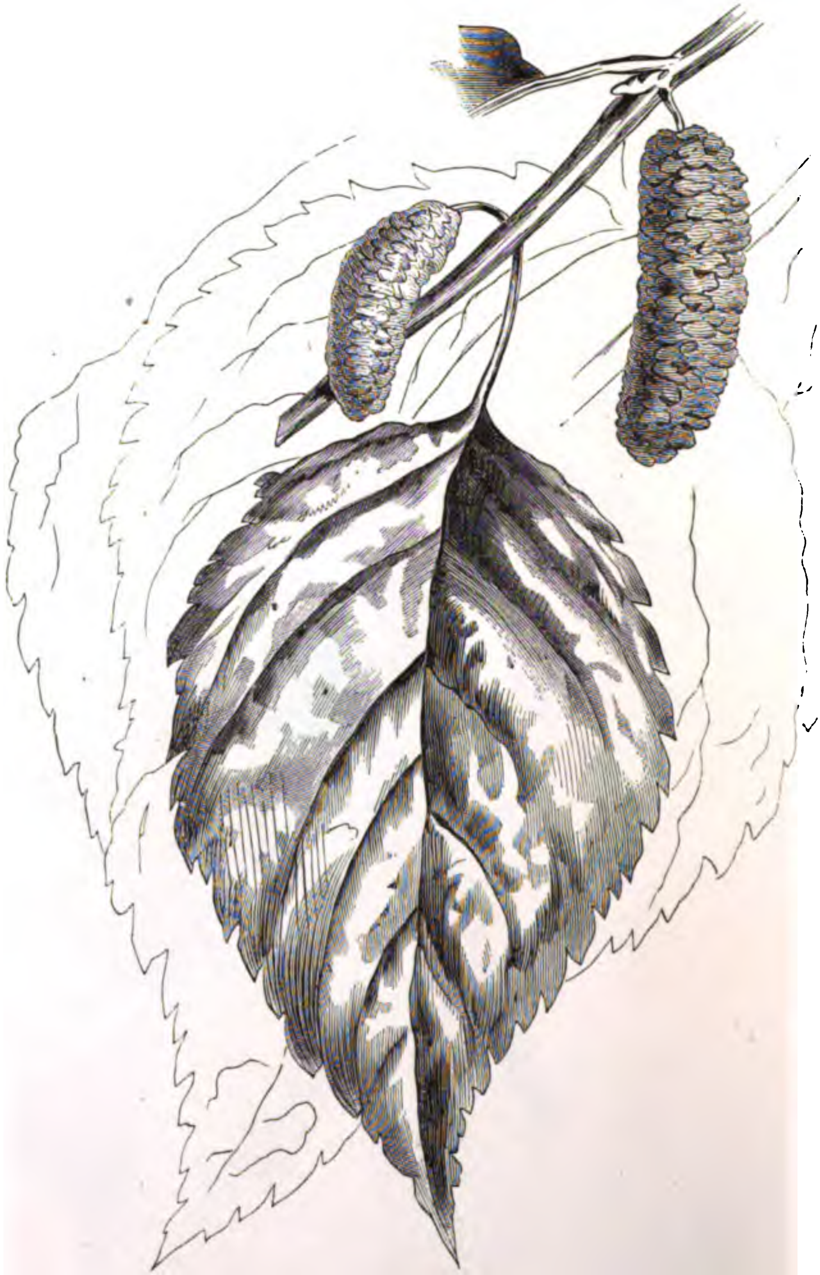
Plate VIII.



GOVERNOR WOOD.



KNIGHT'S EARLY BLACK.



DOWNING'S EVER-BEARING MULBERRY.

This raspberry, for market purposes, on account of its firmness of berry, hardihood of canes and productiveness, has, wherever grown, received praise and commendation.

KIRTLAND.

Fruit.—Size, medium to large; form, round; color, bright red; grains, medium to large, pretty firm; quality, above medium, better than Philadelphia, but not equal to Antwerp or Naomi; canes moderately strong, perfectly hardy, light-yellow, free from spines, very productive.

The origin of this variety is somewhat in obscurity, whether it be a seedling or otherwise. So far it has not been identified with any known sort; the original patch from which plants have been disseminated was found in a fence corner of Professor J. P. Kirtland's grounds in Cleveland, Ohio, and the plants there, as elsewhere, have never failed of producing a crop without protection.

NAOMI.

Fruit.—Size, large to very large; form, roundish, slightly conical, or obtuse conical; hairs, long; grains, large; color, bright, rich red; flesh, firm and sprightly, rich and delicious; canes, strong, with numerous lateral branches when fruiting, brown, smooth, occasional inconspicuous spines; leaves, broad, lanceolate, very productive and hardy.

The Naomi is to the public a comparatively new variety, but observation of it for about twelve years, during which it has been grown without any but good common care in cultivation and entirely without winter protection—it was each year producing large and profitable crops of very superior fruit—induces me to place it in the department report, because of the great interest felt at this time in the cultivation of small fruits. It originated with Mrs. Governor Wood, formerly of Cuyahoga county, Ohio, but now of San Francisco, California.

ORANGE.

Synonym.—Brinckle's Orange.

Fruit.—Size, large; form, conical, sometimes ovate; color, rich deep orange; grains, medium; flesh, rich and high flavored; canes, light gray, very productive; leaf irregular, corrugated.

Originated by the late Dr. W. D. Brinckle, of Philadelphia, one of the most honest and enthusiastic of pomologists. As an amateur fruit it is unsurpassed, but for market is too soft, and the canes being partially tender, it is requisite to lay them down and protect them in winter.

DOOLITTLE BLACK CAP.

Fruit.—Size, small; form, round; color, black; flesh, firm, rather dry, rich, sub-acid; canes, bluish purple, smooth, hardy, prolific.

The Doolittle Black Cap is an improved variety of our common American Black Cap, or Thimble Berry, possessed of greater productiveness and somewhat increased size under cultivation. It is perfectly hardy everywhere, and for private culture or market uses one of the very best.

KIRTLAND RASPBERRY.

NAOMI RASPBERRY.

BRINCKLE'S ORANGE RASPBERRY.

PLATE XV.

DOOLITTLE'S BLACK CAP RASPBERRY.

THE FRUIT REGIONS OF THE NORTHERN UNITED STATES AND THEIR LOCAL CLIMATES.

BY JAMES S. LIPPINCOTT, HADDONFIELD, NEW JERSEY.

The connection existing between the agriculture of any country and its climate is of a character too intimate to permit it to be disregarded by the cultivator. Nor has this connection ever been entirely overlooked. Man may with propriety be said to be a meteorologist by nature; so dependent is he upon the elements that to watch their changes and anticipate their disturbances becomes a necessary portion of his daily labors. Although amospheric phenomena have been subjects of interest to all classes from the earliest ages, and even in our salutations form the ever ready topic of mutual inquiry, to very recent researches are we indebted for any rational and satisfactory explanation of their general laws.

While the results of geological research are everywhere appreciated by the enlightened and even by the common mind, the deductions of the meteorologist are less widely known and held in less esteem; yet it may with truth be asserted that varieties of natural conditions arising from climate do not exert a less marked influence upon man, his labor and its products, than do the geological features of the region he inhabits.

When our British ancestors laid the foundation of the first permanent settlements on the shores of the New World, they were astonished to find themselves exposed to an intensity of winter cold far exceeding that which they had known at home in higher latitudes, or than that which was experienced in France and Italy on the same parallel as the colony they essayed to found. Nor were they prepared to expect the summers of the south of France and of northern Italy in conjunction with the winters of northern Germany and Sweden; yet such they found, and such do we experience to this day. The same want of identity of temperature on our opposite coasts prevails on the American and Asiatic shores of the Pacific ocean in temperate latitudes.

The primary cause of these differences in temperature is doubtless the diurnal rotation of the earth from west to east. The proximate cause is to be found in the presence of vast oceans between the opposite shores, and the immediate cause is the action of counter currents of warm and cold waters and their effects upon the prevailing winds which blow over them and the adjacent land. Treating cursorily of the influence of bodies of water upon the lands by which they are bounded and to which they lie in close proximity, it is not proposed to consider the origin of these great ocean currents, but to accept them as a part of the great machinery by which their waters are made to subserve a more extended and more valuable purpose in the economy of nature, and more largely to bless mankind.

In the existence of water adjacent to land and the diverse properties of these bodies, the different parts they play in receiving and diffusing solar heat, we may find ample cause for the diversities of climate observed on both the opposite shores of wide oceans, and in the limited regions around our inland seas. It is to the consideration of these phenomena exhibited upon our Atlantic coast, and upon the borders of our northern lakes, especially as they influence the capabilities of these regions for the more successful cultivation of our tender fruit, that this paper is devoted. That more enlightened views should prevail is

apparent. A mistaken notion is abroad with regard to our climate, and by many it is still believed that the same winter cold or summer heat may be found by proceeding westward upon any given parallel of latitude. This error we hope to aid in dissipating. Climate is now known to be governed by many causes, among which we may include elevation, or the topography, geological features, and, more especially, the presence of lakes, which it can be shown have a marked effect in softening, to an extraordinary degree, a climate otherwise rigorous. It can also be shown that places but a few miles apart may differ widely in their adaptation to the growth of certain kinds of crops, and that a more northern district need not therefore be colder, nor a more southern warmer, than that from which the emigrant from the eastern States may have removed.

DIVERSE LOCAL CLIMATES.

The United States exhibits very diverse systems of climate under the same parallels of latitude. The emigrants from Pennsylvania and New Jersey, who settled Ohio and Indiana, found a climate whose extremes exceeded those they had known in the same latitude in their former homes; and the hardy pioneers from Vermont and New Hampshire found, and still find, on the borders of the lakes, on the same parallels, a softer clime, a tempered winter, a milder summer, and a longer autumn, than among the hills and mountains of their native States; while beyond the inland seas, among the forests and prairies of Wisconsin and Minnesota, they must encounter rigors of wintry cold scarcely equalled even on the northern border of their New England homes. While they find these successive changes as they move westward, they also learn that the productions vary in kind and quality; that the difficulties they encountered in attempts to extract from the soil the needful sustenance are diminished; that there are districts where fruits seem to grow almost spontaneously, and generously requite the care bestowed, and other sections where the price of successful fruit-growing is, like that of liberty, "eternal vigilance."

One of the most striking peculiarities of the physical geography of the United States is the existence of a series of great inland basins of water lying on the northern border. These ocean-lakes form the most extensive body of fresh water in existence, and comprise more than half of that upon the globe. They cover a space of nearly 100,000 square miles, and are estimated to contain 11,300 cubic miles of water.

The deepest chasms in the crust of the earth are presented, perhaps, by the depressions occupied by these lakes, for, though elevated nearly 600 feet above the surface of the ocean, the bottom of some of them may be twice as far beneath it. Lakes Huron and Michigan, which occupy the deepest chasms, have been sounded to the amazing depth of 1,800 feet without discovering bottom, and their mean depth may be assumed to be about 1,000 feet. Lakes Ontario and Erie are comparatively shallow, the former being about 500 feet, while the latter, with an average of 84 feet, has at its upper reaches the trifling measure of but 30 feet in depth. The presence of these vast bodies of water in the district where the greatest winter cold would naturally be felt, is remarkable evidence of wise and beneficent adaptation of the economy of nature to the wants of man. As in insular climates, surrounded by the ocean, the temperatures of summer and winter are here moderated to a degree not generally appreciated by the residents of other regions, while proving grateful to the inhabitants, increasing their comforts, enlarging the returns of their labor, and enhancing their wealth.

We may treat of the influence of the great lakes under its general and specific aspects. Climates have been divided, for more convenient reference, into excessive, rigorous or continental, and uniform or insular. The interior of the Asiatic continent, and of that of North America, offer illustrations of the first; Great Britain and the Bermudas, of the latter class. Over both the Asiatic and Amer-

ican interior a desert belt extends, in general terms, at from 30° to 45° north latitude. These deserts are, however, of much smaller extent on our continent, but are of similar character where cultivable. The climate of these interior districts is characterized by excessive heat in summer, and extreme cold in winter. In the interior of Tartary, and of Southern Siberia, the thermometer often stands, for weeks together, at 86° or 88°, while the mean winter temperature, during the coldest months, is as low as four degrees below zero. These extremes are paralleled in the interior of the American continent, within the United States, for even in Minnesota the mean temperature for January, 1857, at Hazlewood, latitude 44¾° north, longitude 95½° west, was 3⅓°; at Princeton, latitude 45½° north, longitude 93¾° west nearly, 6°; and at Lake Winnibigoshish, latitude 47½° north, longitude 94° west nearly, 9° for the entire month. These extremes, all below zero, are not for one day at its coldest period, but the mean temperature for all the days of the month of January, at morning, noon, and evening observations. The extreme cold noted at any single observation at the above places, in 1857, varied from 32 to 38 degrees below zero. At the same stations the summer temperatures were very high, reaching to 76¼° for the entire month of July, of the same year, rising at times to 93° and 96°; and at Princeton, Minnesota, the extreme of 101° in the shade was observed. The range of the thermometer, from the lowest of January to the highest of July, was thus 139° Fahrenheit, a range greater than that of any other locality in the United States where accurate instrumental observations have been made. These extreme low temperatures, long continued in winter, and extreme high heats in summer, raising the mean of July and August to a high degree, sufficiently explain the meaning of the terms, excessive, rigorous or continental, as applied to climates as they exist in the interior of Asia and America.

The equable character of an insular climate may be illustrated by the prevailing temperatures of the seasons in southern Britain. In London, which is not, however, in the district most favorably situated to receive the best influences of the ocean, the inhabitants have but once in twenty-five years an opportunity to comprehend the meaning of the term zero on Fahrenheit's scale, and 97° was once, in that long term, felt. The greatest range of the thermometer, in any year of this term, was 91°, and much more frequently this range, or variation from the lowest to the highest measure, has been limited to 60, 65, 76, and 84 degrees. A familiar illustration will exhibit the prevailing uniformity and general moderate warmth of London better than pages of tables and deductions therefrom. In the month of June, in London, when the temperature at noon had reached 65° to 70°, we were once saluted by a tradesman, whose shop we entered, and whose forehead was bedewed with perspiration, with "A very warm day, sir!" "I have not felt it so," was the candid reply. "Why, where did you come from—from India?" he rejoined. "Oh, no, but from America, where we often endure 95° in the shade." "And how do you endure it?" was the response; a question which could not be answered to the satisfaction of a cockney. The climate of the Bermudas, though in the latitude of North Carolina, distant 700 miles, is that of a perpetual spring, mild, genial, and salubrious. The fields are always green. Snow seldom falls, though tempests and hurricanes are frequent. With its extremes of winter and summer temperature we are not familiar; but from the character of its vegetation, above noted, they cannot be far from the means for the months of January and September, which are respectively about 57° and 77°. These are the coldest and warmest months, and differ from each other but 20 degrees. The coldest month at the Bermudas is, therefore, warmer than April at Philadelphia, while the warmest is a few degrees above that of July at the same city. At Penzance, Cornwall, at the southwest extremity of Great Britain, favorably situated to receive the benefit of ocean vapors and ocean winds, the difference between the mean temperatures for January and July is but 19½ degrees. These, it may be said, are extreme cases; we have for this reason

selected them as fitting illustrations. It is true that Penzance and the Bermudas are affected by the Gulf Stream, and therefore warmer than they otherwise would be during the winter; but this circumstance the more strongly illustrates the value of water surroundings upon the climate of an island.

SEABOARD, INTERIOR, AND LAKE CLIMATES COMPARED.

Excessive climates are well exhibited in the interior of North America in the Mississippi valley. Approximations to the insular and equable may also be found within our limits, though much less uniform than in Britain and the Bermudas, yet sufficiently ameliorated to distinguish them from the more extreme districts not far removed, or even from those subject to smaller variations of temperature. In accordance with the diversity in the physical geography, we find that on the sea-coast of New England the influence of the ocean modifies the range of the thermometer, and tends to equalize the temperature of the seasons. As we advance due west, the extreme range of temperature increases, and the seasons are violently contrasted; but as we approach the great lakes, and come within their influences, a climate resembling that of the seaboard appears, and the excessive heats and cold are not known. Proceeding still further westward, and passing beyond Lake Michigan, an excessive climate, that of Wisconsin and Minnesota, is presented. If we should continue our observation on this westward route to the Pacific, after passing the Rocky mountains, with their ever-varying temperatures, due to changing heights and aspects, we should discover a climate on the borders of the ocean more mild and equable than on similar parallels on the eastern coast of North America, or even than that known in western Europe.

Though the mean annual temperature presents little variation on these parallels in the eastern United States, we discover two systems of climate, that of the Atlantic shore and the great lakes, which belongs to the class of mild or uniform, and that of the intervening tract between the ocean and the lakes and beyond the lakes, which is characterized as emphatically excessive or severe. As the mean annual temperatures of places along this line are nearly the same, the difference of climate must be due to the unequal distribution among the seasons; while at places situated on or near large bodies of water, the winter mean is higher and that of the summer lower than at other places, the annual mean may thus be found to be the same as that of places whose winters are cold and whose summers are hot, and whose extremes may nullify each other and not affect the annual average.

The differences between the climates of places near to, or remote from, large bodies of water may be illustrated in several ways. First: By means of tables, in which the difference between the summer mean and the winter mean temperatures are arranged in columns corresponding to the meridian of the places thus arranged, and placing these columns of localities having the same longitude side by side, in the order of progression, along a parallel westward from the ocean, or body of water, which is supposed to modify the climate. Second: By arranging in tables, or otherwise, the differences between the lowest winter temperatures and the highest summer heats. Third: By tracing upon a good map, of moderate scale, a line or isotherm of mean winter temperature, in all its flexures, from a point on the coast to the extreme interior, and contrasting with this a line or isotherm of summer mean temperature similarly traced upon the same map.

On examining the following table, it will be seen that places near the seaboard of New England experience a mean change from winter to summer of from about 40° at Boston to 34° at Nantucket. Passing into the interior, we find that, at the several localities for which we have data at hand, the differences between the summer and winter temperatures vary from 46° at Hanover, New Hampshire, to 43°.7 at Williamstown, Massachusetts, a range of from 6 to 9 degrees greater than that shown by the former column of places exposed to maritime influences.

A table exhibiting the changes in the range of the thermometer in the same longitudes, respectively, and generally between the parallels of 41° and 43° north latitude, arranged, progressively, from the coast of New England to the borders of the desert interior. through thirty degrees of longitude.

Places near the Atlantic coast of New England.		In the interior of New England.		From the Mohawk valley along the Hudson river.	
	°		°		°
Portsmouth, N. H	37.8	Hanover, N. H	46.1	Watervliet, N. Y	46.03
Boston, Mass	40.2	Williamston, Vt.	45.2	Albany, N. Y	44
Newport, R. I	37.5	Amherst, Mass	43.9	Kingston, N. Y	42.98
New London, Conn	39.4	Princeton, Mass	44.2	Newburgh, N. Y	42.15
Nantucket, Mass	34.1	Williamstown, Mass	43.7	West Point, N. Y	41.60
				New York, N. Y	39
				Flatbush, L. I	37.08

Places in the northern interior uninfluenced by water.		Interior of New York partially influenced by the lakes.		Western New York and northern Ohio not distant from Lakes Ontario and Erie.	
	°		°		°
Gouverneur, N. Y	47.41	Hamilton, N. Y	41.36	Rochester, N. Y	40.06
Johnstown, N. Y	45	Oneida, N. Y	42.03	Monroe, N. Y	40.11
More or less influenced by water.		Oswego, N. Y	42.19	Millville, N. Y	39.28
		Mexico, N. Y	41.21	Albion, N. Y	37.04
Sackett's Harbor, N. Y	44.18	Syracuse, N. Y	40.79	Lewiston, N. Y	40.55
Lowville, N. Y	43.67	Cortland, N. Y	40	Fredonia, N. Y	39.40
Woodville, N. Y	42.61			Cleveland, Ohio	37.23

Near Lake Huron and northern and eastern parts of Michigan.		Beyond Lake Michigan, but not distant therefrom.		Distant from the lakes and from latitude 40° to 46° north.	
	°		°		°
Mackinac, Mich	42	Kenosha, Wis	38.6	Fort Ripley, Minn	54.09
Port Huron, Mich	41	Milwaukee, Wis	41.3	Fort Snelling, Minn	54.05
Detroit, Mich	40.80	Chicago, Ill	41.4	Council Bluffs, Minn	53
Near Lake Michigan.		*Remote from the lake.*		Muscatine	51.50
Grand Rapids	39.77	Fort Winnebago	48.1	Prairie du Chien	51.10
Battle Creek	38.33	Beloit	46.7	Kansas Agricultural College	52.20
New Buffalo	36.75	Rock Island	49.2	Fort Madison	52

If we follow the Hudson river from Watervliet to New York bay, we shall find the differences between the mean heats of summer and winter regularly decreasing as we descend towards the sea from 46°.3 at Watervliet; 44° at Albany; 43° at Kingston; 42°.15 at Newburgh; 41°.6 at West Point; 39° at New York, to 37°.8 at Flatbush, on Long Island, near the ocean.

As we approach the minor lakes of New York, the differences between the summer and winter mean decline. Thus, at Hamilton, New York, it is 41°.36; at Oneida, 42°; at Mexico, 41°.21; 40°.71 at Syracuse, and at Cortland but 40 degrees. Near the greater lake, Ontario, a still greater decline is observed; at Rochester it is 40°.6; at Monroe, 40°.11; at Millville, 39°.28; at Albion, 37°.4; while at Lewiston, which is less sheltered, as may be seen upon the map, it rises to 40°.55; at Frederica, near Lake Erie, the range is 39°.40; at Cleveland, 37°.23.

Most of the above places in western New York are on or near the latitude of Watervliet or Albany, several of them on Lake Ontario, further north; yet the most favored enjoys a mean between winter and summer nearly nine degrees less than Watervliet, or a climate more equable by that number of degrees of Fahrenheit's thermometer. Again, the equilibrium of temperature enjoyed at Albion, in Orleans county, adjoining that of Monroe, in which the city of Rochester is situated, and bordering on Lake Erie, closely resembles that known at Newport, Rhode Island, though 125 miles further north than the latter station. The above are but a few of the many illustrations that might be brought forward to show how much the extremes of temperature are moderated by the presence of the lakes and the oceans, how extreme may be the climate of interior limited districts,

and how tempered those extremes, even on the same latitude, by fortunate position.

As we move westward on both sides of the line of latitude followed through New England and New York, and enter the State of Michigan, we find the climate, as expressed by the difference between the winter and summer temperatures, to be not that of New England or of central New York, but that of western New York and the minor lake district. Even as high as Mackinac, at the outlet of Lake Michigan, this difference is but 42°, or about that of West Point; at Port Huron, at the outlet of Lake Huron, 41°, and at Detroit 40°.8, and still further reduced as we approach Lake Michigan, where the range is 39°.77 at Grand Rapids; 38°.33 at Battle Creek, and but 36°.75 at New Buffalo, at the head, or southern extremity, of the lake. We are now beyond the lakes of the northwest, and may expect a change in the climate, gradually passing from the more equable to the extreme. Near Lake Michigan on the west, Chicago exhibits a range of but 41°.4; Milwaukee of 41°3; Kenosha of 38°.6; which approximate to the numbers observed on the eastern shore of this lake, and to those belonging to western New York near its lakes, and to the seaboard of Massachusetts, Rhode Island, and Connecticut. The influence of the lake, however, extends to but a short distance on the west, though, on its eastern side, its effects are known thirty to forty miles therefrom. At Beloit, in Wisconsin, we find the range so often named to be 46°.7; at Fort Winnebago, now Portage City, 48°.1; at Green Bay, 48°.6; while still further west, at Prairie du Chien, it is 51°.1; at Fort Armstrong, now Rock island, further south and in Illinois, it is 49°.2. Continuing westward into Iowa, Muscatine exhibits a range of 51°.5; at Fort Madison, below the line of 41° north, it is 52°; at Fort Dodge, 53°; at Council Bluffs, 53°; while on the north of the line hitherto followed, we find it at Fort Snelling, near St. Paul, to be 54°.5, and at Fort Ripley, 54°.9, both in Minnesota; and, finally, in Kansas, though in the latitude of southern Pennsylvania, and 150 miles south of the general path pursued in our examination, we find a difference between summer and winter mean temperatures of 52°.2, or hot summers contrasted with winter extremes of cold.

If the first method of illustration, by the difference between summer and winter mean temperatures, will not render the subject sufficiently clear, the second, by means of the range between the lowest winter and the highest summer temperature, may be employed.

At St. John's, Newfoundland, the range of the thermometer from the lowest point ever observed to the highest of which we have any knowledge, was about 100°. At Houlton, in the extreme northeast corner of Maine, distant from the ocean, this extreme range has reached 120°. At New Bedford, the range has been 106½°; at New York, 106⅔°; at Albany, 122½°, at Chambly, near Montreal, 128¾°; at Philadelphia, 108⅔°; at Cincinnati, 118°; at St. Louis, Missouri, 132½°; and at Fort Snelling, near St. Paul, Minnesota, 137½°. From this exhibit we perceive that places near the ocean are invariably less extreme, while those more remote suffer from a wider variation of temperature. This difference in the range of the thermometer does not appear to depend upon latitude or longitude, nor upon depression of level or elevation of position alone, but to be caused by proximity to, or remoteness from, large bodies of water.

Again, if the reader will describe, on a map of the United States, the line of mean summer temperature for middle New England, viz., that of 67°, tracing it through New England, New York, and the northwestern States, and also the line of winter mean temperature of 25° through the same general district westward, he will derive therefrom a graphic illustration of the principles set forth.

The isotherm of 67° for summer, or the line which passes through places having that average summer temperature, enters New England near Cape Cod, passes northwest through Salem, Massachusetts, and the lower part of New Hampshire, then turns southwest to middle Massachusetts, in the valley of the

Connecticut, thence to the northwest of the State and along the line of western Vermont, in the low lying valley of Lake Champlain, to Montreal. Here it attains its highest northern latitude and bends abruptly towards the southwest, passing up the valley of the St. Lawrence, whose cool waters have caused it to seek a lower latitude, until it reaches the southern border of Lake Ontario, whence it proceeds in a path nearly westward, slightly flexed by remoteness from, or proximity to, the lakes, until, having passed beyond Lake Michigan, it is rapidly borne away towards the northwest, beyond the parallel of 53° north on the meridian of 110° west from Greenwich, 10 degrees of latitude and nearly 700 miles further north than where it entered the United States at Cape Cod. The extreme heats are thus tempered by the proximity of the ocean and lakes, and excessive temperatures experienced when beyond their influence, at places in the interior; or, in other words, the isotherms of high mean temperatures are deflected to lower latitudes, by the operation of waters, in preventing the accumulation of heat upon the land. The highlands of Vermont cause a downward flexure of this isotherm, and a branch of it, separating from the main line at the head of Lake Champlain, passes over the mountainous region of New York, west of the Hudson, and extends through northern Pennsylvania, where a plateau exists, and curving toward the northwest, leaves the latter State near its northwest corner, to join the main line on Lake Erie. Thus northern Pennsylvania enjoys the summer of Montreal, though distant 300 miles.

Following, in the same manner, the isotherm for the average winter temperature for middle New England, its features will come out in strong relief as contrasted with those of the summer mean of 67°. The average winter isotherm of 25° is supposed to proceed from the lower extremity of Newfoundland. It passes through the lower extremity of Nova Scotia, skirts the coast of Maine, and enters the United States near Portsmouth, New Hampshire. Thence proceeding to Salem, Massachusetts, it encounters there the summer isotherm of 67°, and continues westward, curving towards West Point and extreme northern New Jersey, thence westward by north through northern Pennsylvania, until it passes the Alleghanies and reaches the longitude of the minor lakes of New York, when it is suddenly deflected north, and passing among these bodies of water, extends to Oswego, on Lake Ontario, and thence throughout the length of the lake along its southern shore. Leaving the western extremity of Lake Ontario, it crosses the peninsula of Upper Canada to Port Huron, and curving thence slightly northward in the interior of the lower peninsula of Michigan, descends again to the lake of that name, which it crosses south of Milwaukie, and then rapidly trends southwestward to the 40th parallel on the 95th meridian in Kansas. Kansas may, therefore, have the mean winters of Newfoundland and Nova Scotia, with much greater extremes, though 800 miles further south, because remote from ameliorating surroundings, the warming ocean waters.

THE VALUE OF CERTAIN PECULIARITIES OF WATER.

It may be said that the heat of summer is stored up in the waters, and slowly given out during winter. The summers of an island, or of a district bordering the water, can, therefore, never attain the fervid heats of the interior continental summer; nor can the winters of an island become so severe as the continental winters. These results are due to what is termed the high *specific heat* of water compared with that of the atmosphere.

It might naturally be supposed that, if the same amount of heat were supplied to different bodies, it would raise them to the same temperature, but this is not the result. From the different arrangements of the particles composing various bodies, some require more force than others to develop a given velocity of movement, or heat vibration, or elevation of temperature. This difference of capacity to become heated is called *specific heat*.

The specific heat of water is about twice as great as that of ice, and four times as great as that of air, when equal weights are compared. Hence, a pound of water, by losing one degree of heat, would warm four pounds of air one degree. But as water is about 800 times heavier than air, a cubic foot of water, in losing one degree of heat, would raise 800 × 4, or 3,200 cubic feet of air, one degree higher.

The high specific heat of water, or its remarkable capacity for heat, by which it is enabled to store away, absorb, or render latent so large an amount of heat, fits it for the performance of the various functions required of it in the economy of nature. To raise water to a certain sensible temperature requires a greater consumption of fuel, or longer exposure to sunshine, than is required in raising any other substance to the same degree; and in cooling through a given number of degrees, the same weight of water gives out heat, which, entering the air, or solid substances, is equivalent to considerably greater sensible heat than that lost by the water.

The heat indicated by the thermometer is not, then, the true measure of the actual amount of heat which a body may contain, or be capable of restoring, on cooling. This may seem strangely anomalous, but is now readily explained according to the recent views of the relations of heat to other forms of force, by supposing that the latent heat of fusion is consumed in the work of modifying the adhesion of the particles, so that they lose their character of fixidity, and that the heat, absorbed in evaporation and rendered latent, is employed in generating a repulsive energy, which results in the gaseous condition. Heat is now considered to be but vibrations among the particles of bodies, or to be a "mode of motion." The lost or latent heat is, therefore, but so much "heat motion" expended in overcoming the adhesive force which kept the body in its solid form, or, if changed into vapor, had retained in its liquid state. To use the language of Professor Tyndall, the modern philosopher of heat, "the act of liquefaction consists of interior work expended in moving the atoms into new positions. The act of vaporization is also, for the most part, interior work, to which must be added the external work performed in the expansion of the vapor, which makes a place for itself by forcing back the atmosphere." Such are the views now accepted, and the old hypothesis of caloric, or material heat, has been abandoned as erroneous.

This remarkable endowment of water, which we have endeavored to illustrate, fits the ocean, lakes and broad rivers of the earth to become a vast system for equalizing the temperature of the seasons and the lands adjacent. These bodies of water are engaged in the absorption of a large amount of solar heat during the summer, without rendering them proportionally hot, and emitting it during winter to temper the air above them, without themselves suffering a corresponding fall in temperature. By their agency all latitudes are made more habitable; solar heat, drunk in under the equator, is, by the ocean currents, given out on their way toward the poles, securing a more equable climate to places more immediately exposed to the influence of the ocean, and the heat of our summers in high latitudes is stored up in our lake waters, to be slowly returned during the extremity of winter cold.

Numerous letters of inquiry from interested parties, in various sections of the country, have induced the writer to believe that there is a want unsupplied, and that an attempt to illustrate, even in a cursory manner, the leading peculiarities of districts more especially adapted to fruit-growing, would not prove unacceptable. There are, however, some who even now deny that there is any value in the teachings of the meteorologist; who at once dismiss the results of years of observation and cautious deduction with a flourish, such as: "Really, is it not quite time that this theory of particular locations for fruit-growing was exploded?"

Such hasty questionings, intended as denials of the truths which every experienced pomologist, who has properly examined the bearings of meteorology upon

his art, has fully convinced himself to be of vast importance, are the strongest evidence we can adduce to show the need of a clearer understanding of the laws of meteorology as respects the influences of local surroundings in modifying the temperature, equalizing the extremes of a climate, and fitting it for the production of fruits which cannot generally be successfully grown in less favored districts.

It is as important to know what we cannot do as it is to learn what is within the scope of our abilities. Let us, then, look at the facts derived from the experience of the farmer and the fruit-grower, observe how they sustain the deductions of the meteorologist, and learn how their combined teachings may be employed in determining the value of other districts, where, by the operation of general physical laws, they must be equally applicable. We may thereby encourage some to use aright opportunities now unemployed, or may caution others against expenditures of time and labor in what must prove fruitless enterprises.

THE NEW ENGLAND COAST, CHAMPLAIN REGION, AND SHORES OF LONG ISLAND.

Beginning in Massachusetts, near the seaboard, we find excessive heats, excessive cold, long-continued droughts, and frequent late spring frosts. Even the conditions so unfriendly to successful fruit-growing would seem to be but little modified by the presence of the ocean. But that they are less extreme in its immediate vicinity, though more variable, is well known, and we doubt not that the superior success which has attended the growing of the pear near Boston is in a great measure due to the ocean. The early blossoming of fruit trees may be retarded by the presence of the cold masses of water present on the coast of New England, which are a continuation of the north polar current setting out of Baffin's bay, and here closely confined between the Gulf Stream and the coast, and driven more strongly thereon by the diurnal motion of the earth. Winds from the northeast must, however, frequently affect the coast of Massachusetts unfavorably, even after the land has been somewhat warmed, and after vegetation has been advanced by the counter trade-winds. That this cool current of water modifies the mean temperature of the seaboard of Massachusetts, New Hampshire, and southwestern Maine, is evident from the fact that this line of mean temperature of 65° for the months of June, July, and August extends in a curve from Cape Cod to Bangor, parallel and not distant from the coast; while that of 67° for the same period is found ranging parallel to the above from Nantucket, through Boston, Salem, and Portsmouth, and that both these lines are rapidly deflected towards the northwest, and find their highest northern latitude at Quebec and Montreal, respectively, indicating a summer warmth at the latter places equal to that known at Boston, though 250 miles further north. It may be unfortunate for New England that it is placed on the western side of a cold current, and has no protecting waters on the west and northwest. Lake Champlain is, however, a valuable shelter on the west side of Vermont, and the climate of that State, in the valley not distant from the lake, is thereby ameliorated to a considerable extent. The island of Nantucket is a more favorable instance, for while her summer mean is about that of Montreal, her autumn and winter are those of Philadelphia.

Notwithstanding that the climatic conditions of the general seaboard of Massachusetts are adverse to successful fruit-growing, there is a district which is less unfavorable, as is shown by results. Hon. M. P. Wilder stated, in 1862, that his pear orchard had produced 1,000 bushels, and that his most sanguine expectations had been realized. This garden contains 14 acres and 900 varieties in bearing state, forming a perfect museum for those who would study this fruit. In 1866 there was scarcely half a crop, though many trees were finely loaded. The crop of 1865 was likewise deficient, the past two seasons having been attended by successive droughts of extraordinary severity. Though but half a

yield, the surplus fruit of the market varieties not needed by the proprietor sold in 1866 for $2,000. W. R. Austin, of Dorchester, Massachusetts, in the same town as the pear orchards above referred to, had also a pear plantation on the quince root, which has borne regularly for six years, producing, from 500 or 600 trees, upwards of $3,400. The site of these pear orchards is but a few miles south of Boston, near the bay, and on a peninsula enjoying a favorable exposure to water influences. It is said that the Bartlett pear in Massachusetts, and the Buffum pear in Rhode Island, have not failed to produce an annual crop for from twenty-five to fifty years, thus adding proof to the assertion, that success is almost always certain when judicious selection of varieties has been made in localities adapted to their culture.*

The Concord grape was very productive in Massachusetts near the seaboard In Walpole, "eight tons were raised from one acre, and seven tons is not an unusual crop." (Country Gentleman, August 31, 1865.) The grapes command a ready sale, and the wine made therefrom, when three years old, in the language of the reporter of these "facts," is "almost unsurpassable." The Concord vines were loaded with fruit, as we may readily suppose, to produce as above stated, and were perfectly healthy, though some local mildew appears on other varieties, the Catawbas and Delawares being the most affected. More distant from the seaboard, inland, as in Connecticut, near Hartford, Concords and other hardy varieties were mildewed and rotted, and the only kinds perfectly adapted to the soil and climate are the wild fox grapes, whose fruit is inedible.

On the eastern shore of Lake Champlain the apple and pear are successful, and in Vermont the valley of the lake is celebrated for its fruits. Peaches do not flourish near Burlington, and are seldom planted. A few more hardy grapes, requiring a short season only, succeed; but the winters are severe, and they need protection by covering, &c. The lake is from a half to ten miles wide, and from fifty to two hundred and eighty feet in depth. Its influence is no doubt valuable, but its moderate width and depth, and high northern latitude, limit its utility as a regulator of the heat and cold of the border region. The value of the orchard products of Vermont in 1849 was about $315,000, and in 1859 upwards of $211,000, more than one-half of the products in each year grown in the valley of Lake Champlain.

New York presents a noteworthy instance of a city refreshed by sea breezes in summer, with a winter tempered by their influence. Long Island, Queen's county, is mild, agreeable, and healthy, the season early, with frosts occurring late in autumn; consequently, fruits there attain great perfection. Grafts from new varieties of pears inserted into the tops of old Virgalieus, which for twenty years had been barren, have, for several years past, produced full crops of fruit of a high order of excellence. "Hence, it is probable," says an intelligent grower on Long Island, whose wide experience with pears renders his judgment worthy of respect, "that the difficulty met with in the cultivation of many of our fine pears is simply atmospheric, having but little to do with the soil on which they grow." Many excellent varieties of pears were in full bearing in Queen's county, Long Island, in the summer of 1865, where, however, success is almost always well assured.

Perhaps the most favored spot on Long Island on account of soil and proximity to the mild atmosphere of the ocean, is the neighborhood of Bay Ridge As unseasonable frosts are seldom troublesome here, the owner of a few acres is often able to supply the market very early in the spring, and the consequence is a golden harvest. Thus a Bay Ridge farmer sold potatoes in the early summer

* The accomplished editor of the Horticultural Department of the Country Gentleman states that, "in riding about the environs of Boston, almost every garden and corner of a yard appears to be crowded with pear trees, vigorous and healthy, and many of them bending under heavy loads of fair fruit, and that in this year (1866) of small crops."—*The Cultivator and Country Gentleman: September* 20, 1866.

of 1865 at $3 50 per bushel, another sold 50,000 cucumbers in one day, and yet another realized $800 for a single crop of cauliflowers. We are informed that an income of $8,000 to $10,000 from a farm of 30 acres is by no means extraordinary.

These results are obtained by skilful rotation of crops, with high manuring on a soil admirably constituted as well as most happily located to receive the best influences of the ocean.

Along the eastern shore of the Delaware river above Camden, opposite Philadelphia, is a narrow district extending but a few miles in length, known as Pea Shore. Here the early product of peas and tomatoes is always found certain and highly remunerative, because ready for the market from one week to ten days earlier than those grown on lands but a mile distant inland. This district, bordered by the river on its west, has before it an expanse of water wider than the ordinary breadth of the Delaware. The profits on similar crops when compared with those grown on inland farms, are here from 60 to 100 per cent. greater because of the longer season and the earlier product.

THE SMALL LAKE COUNTIES OF NEW YORK.

The interior counties of New York which are bounded on the west or northwest by small lakes are invariably favored with a climate mild and equable. Thus Onondaga is pronounced more uniform than some other parts of the State, having Skaneateles lake on its west, while Madison county on its east, more elevated, is subject to untimely frosts. Cayuga is mild and temperate, its extremes being much moderated by the numerous bodies of water in and around it. Seneca is mild and temperate, situated between considerable bodies of water which seldom or never freeze, thereby preventing the continuance of snow and essentially modifying the climate. Fruits here attain great perfection. Yates county is temperate, and for the cultivation of fruit is unsurpassed by any county in the State. Canandaigua lake forms part of its northwest boundary, Seneca is upon its northeast side, and Crooked lake is mostly within its limits. Tompkins county is agreeably modified by the presence of Seneca and Cayuga lakes on its west and northwest. Ontario county has within its limits Canandaigua, Honeoye, Candace and other lakes. In both the climate is mild and agreeable, and fruits thrive well. Steuben county, with its Crooked lake, has become known as a seat of successful vine culture.

The counties which compose the western part of New York, whether bordering on Lake Ontario or Lake Erie, or more remote, are all described as mild and equable, and more or less adapted to the growth of fruit. Those lying immediately on the lakes, as Wayne, Monroe, Orleans, Niagara, Erie and Chautauqua, and therefore more directly affected by the waters, have a smaller range of the thermometer, or a more uniform climate, in which the hardier fruits regularly attain great perfection. In contrast with these favorable conditions may be cited the counties of Albany, Schenectady, Saratoga and Madison, on the same parallel or further north, scarcely more elevated, and yet subject to extremes of heat and cold, and, some of them, to untimely frosts. The counties near the southern boundary and others in the southern district are too elevated to become proper subjects for comparison. Again, the counties of St. Lawrence and Jefferson, though their winters are severely cold, because unprotected by waters on the northwest, possess a climate less variable than that of most other counties of the State, their summer heats being moderated by the breezes from Lake Ontario. Thus every county in the State under review which holds in its embrace unfrozen waters, enjoys greater exemption from early and late frosts, winters less rigorous, summers more tempered, and, in general, a climate more mild and equable than others not so situated. In the counties of New York so favored, the cultivation of fruits consequently becomes a business more certainly remunerative.

The wide difference between the eastern and western portions of the State of New York were early noticed. Says Chancellor De Witt in a letter to Sir Humphry Davy: "There is evidently considerable difference between the climates of the eastern and western parts of the State. Cayuga and Seneca lakes are situated about 150 miles west of the Hudson river, and each is nearly 40 miles long and from one to three and a half miles wide. Both have their centres nearly in the latitude of Albany, and yet they have hardly ever been known to freeze over, excepting at the extreme ends, while the Hudson river never fails to be frozen, commonly for two or three months of the year, for many miles to the south of Albany, not unfrequently to the distance of 100 miles, so as to bear the travelling of horses and carriages thereon. While peaches and nectarines are raised at Albany with some difficulty, they flourish nowhere better than in the western part of the State."

A view of the diverse characters of the different districts of the State, derived from thermometric comparison, will display in a striking manner the effects of location as respects elevation and proximity to the ocean, the Hudson and the western lakes. The distinguishing feature of the climate of Long island is the uniformity of its temperature. Here the greatest heats are about 1½ degree less than the average in other parts of the State further north and more elevated, while the extreme cold of winter is less by from 10 to 18 degrees, and had been uniformly so from 1830 to 1846, the period of time over which the observations extended.

As we ascend the Hudson the opening of the spring becomes gradually later, the difference in time between New York and Albany being one week. At places near the mouth of the Hudson, but some distance inland, vegetation seems to be no further advanced than at the city of Hudson, which is upon the bank of the river, but 100 miles from its mouth.

The valley of the Mohawk is one degree lower than the averages of the State, and nearly one degree lower than is due to the latitude and elevation of the places of observation. Regions north and west of the valley of the Mohawk, with the exceptions of Ogdensburg, on the St. Lawrence, and Plattsburg, on Lake Champlain, have all the characteristics of a more rigid climate, low mean temperature, extreme cold in winter, great range of the thermometer, backward seasons, and early frosts.

In the elevated region south and southwest of the valley of the Mohawk, the thermometer sinks lower than the average of the State by from 4 to 11 degrees, and the autumnal frosts occur earlier by from four to thirteen days.

As we pass from the east into the basin of the smaller lakes, we find the mean temperature higher than is due to the latitude, while in the eastern section of the State it is generally lower than is due to its position. The winds are also eleven degrees more southerly than is due for the mean of the State. In the western part the mean temperature does not differ much from the average of the State, but is remarkably uniform, more so, indeed, than any other section except Long Island. Here the average annual range is but 96 degrees, while in the State of New York generally it is 104, and in the northern counties, nearly 120 degrees. The coldest winter at Rochester, Lewiston, and Fredonia but little exceeds that known on Long Island or at New York.

THE SEABOARD OF NEW JERSEY.

The seaboard of New Jersey demonstrates in the amplest manner the truth which this essay is designed to inculcate, and is becoming an attractive field for the fruit grower. The very many inquiries made respecting this region prove that an interest has been awakened in its capabilities. I have recorded the results of observations and inquiry extended over several years, and can speak in favorable terms of the promise of some hitherto neglected portions of this fine

State, already the garden of the Union. The experiment of grape-growing is of but recent inception at the several newly settled places on the eastern border, near or more distant from the ocean. A few instances of longer culture appear, one of which we cite.

In Atlantic county, New Jersey, 15 miles distant from the ocean, the crop of Isabellas and Catawbas had not failed for ten years prior to 1866, the period during which our informant has cultivated them. The vines have never lost their leaves, nor have the grapes suffered from rot or mildew to any injurious extent, were uniformly healthy, and produced large and well ripened crops. The highly unfavorable seasons of 1864 and 1865, though causing some leaves to drop from the Isabellas, did not greatly injure the crop of fruit. The crop of grapes in 1866, at places not immediately on the ocean shore was, however, much diminished by the effects of the extraordinary and sudden onset of cold in January. This exceeded anything "known to the oldest inhabitant," and should not impair the confidence of planters of the vine in this district. The vines have again made good growth, and, in the language of the oldest grower, "the prospect is as good as it ever was for the coming season. No mildew nor rot appeared in 1866."

At Atlantic City, New Jersey, is a small vineyard which was in fine condition when seen in the autumn of 1866, the new growth having ripened to the extremities, showing the existence of healthy foliage during a long season. Here Delawares and Concords fruited well, and, moreover, had not lost a leaf during the trying summer preceding.

At Leeds Point, Atlantic county, New Jersey, on the poorest of hill-sides, abounding in sandy gravel, might be seen in September last three acres of Isabellas and Catawbas heavily laden with magnificent fruit, almost perfect in waxen bloom, in their second year of bearing, but producing their first full crop. A few plants were divested of leaves, but were always found standing in dishing hollows where the gathered surface waters had washed the finer clay and destroyed the drainage. On many of these vines, both Isabella and Catawba, the writer saw from 20 to 50 superb bunches of fruit, worthy a premium at any exhibition he had witnessed, and which did, indeed, receive such an award at the county fair.

The land on which the above grapes grew would not have produced five bushels of corn per acre. At the fair held in Boston, 1865, Duchess pears, weighing 24 ounces, were selected to illustrate the extraordinary superiority of the pears then on exhibition. Adjoining the above vineyard of Captain Towers Townsend, on the white sand so unpromising, the same variety of pear was grown weighing fully 24 ounces.

Near Absecom, Atlantic county, distant five miles from the ocean, but adjoining the low, almost flooded salt marshes, another vineyard, which has been in bearing longer, presented almost equally good returns, though the Isabellas suffered from overbearing. Here five-eighths of an acre had annually produced grapes, which for several years sold for $350, or at the rate of $480 per acre. Other vineyards in the same district were equally successful, very little mildew or rot having been observed when planted on coarse sand. The cold of January, 1866, was very injurious to this vineyard, already weakened by overcropping. Near Tom's river, Ocean county, New Jersey, a few miles from the seaboard, the experiment of grape-growing is also in progress. Here S. B. Parsons, one of the proprietors of the great commercial nurseries at Flushing, Long Island, has planted a vineyard. In his statement before the Lake Shore grape grower's meeting at Cleveland, Ohio, he expressed himself much gratified with the results, especially in the growth and healthiness of a young vineyard of Delawares now ready to commence bearing. He thought that the proximity of the ocean had much effect, and would insist on a location near a large body of water as a prime requisite for successful fruit-growing.

Following the line of the Camden and Atlantic railway inland, ten miles from Absecom, the first important scene of grape culture will be found among the Germans of Egg Harbor City, who have upwards of 200 acres planted with vines, some of them a few years in bearing. When on land well chosen, their Catawbas were heavily laden with large bunches of waxen berries, generally with fair large leaves and a very moderate growth of wood. On some of them mildew had appeared. On one vineyard of 3½ acres and 4,000 vines, of which about half were in bearing, 1,800 pounds of fruit had been taken in 1865 and sold at 15 cents per pound. These returns encourage an extension of the business, and upwards of 100 acres will probably be planted in 1866. At Egg Harbor City, those who grow grapes for wine prefer Norton's Virginia Seedling, Clinton, Concord, and Catawba, in the order named. The Delaware made a good growth but lost its leaves early in this section.

Upon the Camden and Atlantic railway, distant ten miles from Egg Harbor City, and twenty-five miles in a straight line from the outer ocean shore, is Hammonton, a settlement of New Englanders, in pursuit of health, wealth, and warmer skies. Here are 200 acres in strawberries, 50 in blackberries, and, in 1866, 100 acres of vines under cultivation. This district is unfavorable to the growth of the Catawba, Isabella, Diana, Delaware, and many other more tender varieties, all of which have been more or less affected by mildew and rot, for several years, but seems adapted to produce in perfection the fruit of the Clinton and Concord only, in unfavorable years. The Concord vineyards at Hammonton have proved very productive, returning, in 1864, 14 pounds per vine, on stakes, and, in 1865, 8 to 10 pounds, which sold at 20 cents per pound. The aggregate per acre was, in one instance, 1,600 pounds, and in another, 3,600 pounds in 1865. This partial success encourages more extended planting; though, in the opinion of an intelligent resident much interested, no variety of vine has succeeded perfectly at Hammonton.

More remote from the ocean, or entirely beyond its influence, in Camden county, the Delawares, the Isabellas, Catawbas, and Dianas were much mildewed, their leaves almost universally blighted, and their fruit rotted or shrivelled, and worthless. The vines, of almost every variety, presented an unhealthy appearance, and many were killed, branch and root. A few Concords only rewarded the grower's care in 1865–'66. Beyond the Delaware river, in the southeastern section of Pennsylvania, Delaware vines lost their leaves in the middle of August; and, where tons of grapes were expected, perhaps not ten pounds of perfect berries were found in the vineyards of some growers. The experience of 1866 was of similar character.

THE STATE OF DELAWARE.

In the State of Delaware selected varieties of the pear do well, but the more valuable grapes do not promise as well in the interior of the peninsula as is desirable. From localities along the bay shore, within a very short distance, we have no reports, if, indeed, vines have been tried. Near Smyrna, seven miles inland from Delaware bay, the Delaware vines mildewed in 1864 and 1865, and the leaf blight was general, with much injury from the rot. In this peninsula, between the Chesapeake and Delaware bays, and not distant from the former, at certain selected locations, the peach continues to be grown with success, which is often highly remunerative. Many of the orchards are very extensive; one of the best known is that of the Reybolds, embracing upwards of 1,000 acres. The crop, while maturing, requires two steamboats for its conveyance to market. The net profits, for the last three years, are estimated at about $300,000.

The rising value of lands in the State of Delaware, on which the peach can be grown, and the extraordinary profits derived therefrom, are well exhibited by a correspondent of "The Cultivator and Country Gentleman" for March 28, 1867.

"Thirty-five years ago," he says, "2,800 acres, near Odessa—formerly Cantwell's Bridge, New Castle county, Delaware—were offered for sale for $2,600. This tract is now divided into half a dozen farms, on one of which, owned by Mr Fenimore, a crop of peaches netted, in 1855, $20,000, and in 1856,* $28,000. A farm of 151 acres, two miles from Odessa, sold recently for $30,000, and the purchaser was offered an advance of $2,000 a few days afterwards. The farm of G. W. Karsner, near McDonough, in New Castle county, of 300 acres, was bought for $14 per acre thirty-five years ago, and is now assessed at $150, and valued at $250, per acre. Another farm of 170 acres, also near McDonough, without buildings, and nearly without fences, sold at public sale, in October, 1866, for $120 per acre. A gentleman near Middletown, who was willing to sell his orchard, last spring, for $1,500, was afterwards offered $5,000 therefor, and refused it. His crop of peaches subsequently sold for $2 per basket, and netted him $9,000. Another crop is reported which, though grown on poor soil, where the peach trees maintained a doubtful contest with the sassafras bushes, netted the proprietor $20,000 in the season of 1866!"

On the eastern shore of Maryland, bordering the Chesapeake bay, the peach and other tender fruits find a congenial clime. The influences of the wide bay, and its numerous arms extending inland, embracing many peninsulas, is here of great utility in moderating the temperature and preventing the extremes elsewhere so detrimental to the peach.

THE VALLEY OF THE HUDSON RIVER.

The valley of the Hudson has long been justly famed for the excellence of its fruits. Here, some of the finest varieties of apples, pears, and grapes originated, and here many kinds attain a great degree of perfection. New orchards are being planted, and many farmers are introducing the hardier grapes, and small vineyards have already been established in several of the river counties. A marked improvement in the product and quality of the fruit raised is reported. The tides of the Hudson river appear to affect the temperature of the adjacent shores for some distance inland. The warm currents from the ocean diffuse a warming vapor over either shore, which retards the frosts of autumn, and prevents the later frosts of spring, while vegetation is often injured or destroyed at places in the interior, and winter has scarcely departed from the hills and mountains not far distant.

In the New York Tribune of September 16, 1865, grapes were reported to be quite abundant in the market. Most of ese were doubtless grown on the Hudson and interior lakes. One fruit-grower at the Palisades, twenty-two miles north of New York city, reports that his crop of Isabellas was fine, and that his Rebeccas and Rogers's Hybrid No. 1 did well, while rot destroyed his Catawbas and Dianas. Several varieties of pear trees were loaded with fruit, at the same place. Near Fishkill Landing, on the Hudson, the Catawba is raised with almost entire certainty, every year, on lands not distant from the river, and at a low level. In the vicinity of Newburg, the crop of fruit in 1864 was almost perfect, and at the exhibition in 1865 were presented, in the esteem of the viewers, "the best out-door grapes ever exhibited in the Union;" yet, in the district around these favored spots, it was reported as the worst season heretofore known for rot and mildew of fruit and leaves. The vineyard of H. W. Murdfelt, near Newburg, Orange county, New York, comprising about half an acre, of 250 vines, produced, in 1861, 3,700 pounds of Catawba grapes, which sold for 14 cents per pound. At New Paltz Landing, Ulster county, in 1861, the vineyard of Charles Wooley, of three-quarters an acre, produced four tons of Catawbas and Isabellas. At Poughkeepsie, Dutchess county, S. B. Trowbridge produced $1,000 worth of grapes on one acre; and Isaac Merritt, and others in the same

* 1865 and 1866. (?)

district, obtained results equally as good. The Croton Point vineyards of Dr. R. T. Underhill have long been famous.

THE VINE-LANDS OF CROOKED, SENECA, AND CAYUGA LAKES.

In Steuben county, New York, two townships only produced grapes in 1864, worthy of notice on account of their value. Both these are located on Crooked lake. The town of Pultney returned to the collector of statistics upwards of $3,000, and Urbana nearly $47,000, for this fruit alone, while the total value of the grape yield for the county was less than $51,000. Near Hammondsport, in Urbana township, 36,000 gallons of wine were made in 1864. The success which has attended energetic vine-culture near Crooked lake will be evident from a few statistics of the crops. The first vintage of the "Pleasant Valley Wine Company" was made in 1860, when they gathered about 36,000 pounds of grapes; the second, about 39,000 pounds; the third, 270,000 pounds; the fourth, about 190,000 pounds; and the fifth, (in 1864,) about 500,000 pounds, or nearly 250 tons. In 1862 they made about 11,000 gallons of wine and 3,400 of brandy; in 1863, about 9,800 gallons of wine and 1,400 of brandy; in 1864, about 30,000 gallons of wine, and brandy in proportion to that of former years. About one-third of the crop in the valley was consumed in the manufacture of wine and brandy, and the remainder sold in market for table use. In 1865, 15,000 gallons of wine and 1,000 gallons of brandy were produced by the same company. The total product of the region, in the same year, is said to have been about 40,000 gallons of wine, though this is not a fair exhibit of the fruit crop of the valley, since the high price of grapes in the New York market caused the shipment of 100 tons as fruit and the purchase of 50 tons of Catawbas from Kelley's island for conversion into wine. We have seen it stated that the entire product of this valley in 1865 may be estimated at upwards of 255 tons of grapes, valued at $110,000. The wines of the first three years are sold, and the brandies sell as fast as manufactured, and orders accumulate. The grapes not turned into wine find a ready sale, at from 15 to 30 cents per pound. From the beginning of grape-culture at this place in 1855 nothing like a failure of the crop has occurred, and nothing like disease of the vine or of its fruit has appeared. During the year 1864, the area of grape-culture in the valley was much extended. At present it stretches more than two miles along the western shore of the lake. Lands have advanced in value beyond the anticipations of the most sanguine, $300 per acre having been paid for choice locations, and vineyards are valued at $1,000 per acre. The return from an acre has averaged about two tons of grapes, valued at $250 to $400, according to quality. This strip of territory, on the western side, extends the entire length of the lake, with an average breadth of five-eighths of a mile, more than 7,000 acres, it is said, being suited to the production of the grape. In 1865, 1,500 acres of three-year-old vines comprised the extent of surface thus occupied.

Crooked lake is included within the limits of Steuben and Yates counties, in southwestern New York. Its length is about eighteen miles, and its greatest breadth one and a half miles. About midway it is divided into two forks or branches, one of which is about five, and the other eight or nine, miles long. Its surface is 487 feet above the level of Lake Ontario, or 718 feet above the Atlantic ocean. It is of great depth and purity, and remains unfrozen during most of the winter, and does not become chilled throughout until late in the season, therefore aids in prolonging the growing season into autumn, by preventing the appearance of early frosts. The lake is nestled in a hollow, around which rise hills in a succession of terraces, frequently from 400 to 500 feet, while the general elevation of the table land, more distant, is about 1,500 feet above tide-water. This high land forms, on the western side of Steuben county, the dividing ridge between the head-waters of the Susquehanna and those of the

Genesee river. The soil of these hills is a shaly loam, disintegrated to a great depth, abounding in crevices, affording ample drainage.

On the shores of Cayuga lake the grapes were extremely fine in the season of 1865, and, in the opinion of residents, the district for ten miles therefrom is destined to become a great grape-growing country. For many years the valley at the head of this lake has been noted for its fruits. As early as 1858 one thousand gallons of wine were made here. In May, 1842, a frost almost entirely destroyed the grapes at places more distant from the lake, while those in close proximity escaped with but little injury. Seneca lake is another long, narrow sheet of water, about thirty-seven miles in length, and from two to four miles wide. It has an elevation of about 210 feet above Lake Ontario, and is in the midst of a district noted for its beautiful and varied scenery. This lake is upwards of 630 feet deep, and was never known to be frozen over until March 22, 1856. Here the hills slope gently down to the water's edge from a height of about 800 feet, and the highlands are from a mile to a mile and a half distant. The finest wheat farms in the Union lie along its shores; but the time is rapidly approaching when grain will cease to be grown in this valley, so wonderfully adapted by soil and climate to the production of the grape. Several vineyards are already in bearing, producing Isabellas and Catawbas of great excellence. Frosts do not occur here until the last of October, and the Catawba ripens well. Two and a half to four tons per acre have been produced, which sold at the average price of fifteen cents per pound. The lake is here understood to be the agent which renders the valley so well adapted to the growth of the grape.

At the head of Canandaigua lake, in the town of Naples, the Isabella and Catawba have been successfully cultivated for several years past, ripening much better, and escaping disease more frequently than near the shore of Lake Ontario. At the exhibition at Rochester, in 1865, the best Isabellas and Catawbas were grown by J. W. Clark, of Naples. There is said to be quite an area of grape lands unimproved in Naples, upon which the culture might be much extended. The favorable locations do not appear to be dependent on any marked influence exerted by the lake, as its distance is too great and its shallowness unfavorable to the belief that it can prove of much valuable service in prolonging the season. The valley is warm, sheltered, and on the slopes, elevated sixty to eighty feet above the lake, the spring frosts are early, and the autumnal frosts later, which may be the cause of success in this region. The soil is highly favorable, being of drift, warm, and porous.

Waterloo, New York, where the grape has been successfully cultivated for several years past, though on the outlet of Seneca lake, is not near enough to be influenced by its waters in seasons of great extremes of temperature and dryness. Thus, in 1865, the high temperature of August, accompanied by frequent showers, followed by extreme low temperature by night, even here caused the leaves to curl and fall, and the fruit to shrivel and drop from the vine. Even the Clinton was blighted as badly as any others in the vineyard of F. C. Brehm, one of the most skilful and successful amateur grape-growers of western New York.

STATISTICS OF THE FRUIT CROP OF NEW YORK.

In western New York fruit culture has attained gigantic dimensions, by reason of the nearly uniform success which has attended this branch of agriculture. The orchard products of 1849 were estimated at about $1,750,000, and in 1859 at nearly $4,000,000, or twice as great as those of any other State in the Union. More recently this product has been estimated at $6,000,000 annually.

The following table of statistics of orchard products, according to the United States census of 1850 and 1860, which comprehended the growths of 1849 and 1859, respectively, together with the rate of increase or decline in each of the fruit-growing counties, and in the several divisions of the State, as classified, will exhibit in a strong light the comparative merits of the respective sections, and the rapid advancement in the more favored regions from 1850 to 1860:

HUDSON RIVER COUNTIES.

	1849.	1859.	Per cent. increase.
Albany	$36,000	$86,000	136
Rensselaer	57,000	72,000	23
Greene	21,000	54,000	149
Columbia	16,000	59,000	200
Ulster	29,000	35,000	20
Dutchess	16,000	92,000	412
Orange	16,000	41,000	156
Putnam	15,000	14,000	0
Rockland	5,000	8,000	60
Westchester	68,000	151,000	122
Queens	64,000	62,000	0
Total	343,000	671,000	95

COUNTIES IN OR SOUTH OF THE VALLEY OF THE MOHAWK, AND WEST OF THE HUDSON, CHIEFLY MOUNTAINOUS.

	1849.	1859.	Per cent. increase or decline.
Herkimer	$47,000	$31,000	—34
Fulton	17,000	10,000	—41
Oneida	88,000	100,000	13
Madison	38,000	44,000	16
Montgomery	30,000	27,000	—10
Schenectady	15,000	13,000	—13
Oswego	44,000	43,000	— 2
Schoharie	33,000	47,000	42
Delaware	25,000	28,000	12
Sullivan	9,000	14,000	55
Total	346,000	357,000	3.2

COUNTIES AROUND THE MINOR LAKES.

	1849.	1859.	Per cent. increase.
Onondaga	$67,000	$107,000	60
Cortland	21,000	30,000	43
Chenango	19,000	46,000	130
Cayuga	61,000	141,000	141
Seneca	27,000	96,000	255
Tompkins	24,000	70,000	191
Schuyler, (taken from Steuben)	....	....	....
Yates	22,000	74,000	240
Ontario	49,000	204,000	300
Total	290,000	768,000	165

SOUTHERN TIER OF PLATEAU COUNTIES.

	1849.	1859.	Per cent. increase or decline.
Broome	$6,000	$29,000	383
Tioga	5,000	26,000	420
Chemung	6,000	17,000	183
Steuben*	31,000	32,000	....
Allegany	44,000	1,263	—97
Cattaraugus	24,000	10,000	—58
Total	116,000	115,263	Decline.

* Steuben was divided in 1855 by the separation of Schuyler, which also received a portion of Tompkins.

COUNTIES BORDERING ON LAKES ONTARIO AND ERIE, OR NOT DISTANT THEREFROM, IN THE WESTERN PART.

	1849.	1859.	Per cent. increase.
Jefferson	$43,000	$46,000	7
Oswego	70,000	107,000	53
Wayne	83,000	161,000	94
Monroe	67,000	367,000	450
Orleans	34,000	228,000	570
Niagara	32,000	243,000	660
Genesee	13,000	115,000	720
Livingston	20,000	51,000	155
Erie	45,000	52,000	15
Wyoming	22,000	62,000	180
Chautauqua	27,000	72,000	166
Total	456,000	1,504,000	280

The United States census contains returns of the value only of orchard products, while that of the State of New York reports in bushels, disregarding values in many instances; consequently the data are often incapable of comparison. The New York State census for 1855 exhibits a vast product of apples; but the census of 1865 is not sufficiently advanced to enable us to compare it with the former. The returns for eight counties exhibit a decline in some and a marked increase in others.

As the census report of New York is not generally accessible, we annex a table of the apple crop of that State for 1855, a minor table of peaches, pears, and wine product, to which may be added that of plums to the amount of 8,604 bushels, valued at $11,232, which may appropriately conclude our exhibits of statistics.

Apple crop of the State of New York, according to the census of 1855.

Counties.	Bushels.	Counties.	Bushels.
Albany	234,251	Ontario	397,098
Allegany	214,136	Orange	80,180
Broome	224,463	Orleans	281,781
Cattaraugus	177,173	Oswego	425,915
Cayuga	522,751	Otsego	601,096
Chautauqua	368,115	Putnam	27,158
Chemung	107,364	Queens	3,346
Chenango	553,554	Rensselaer	131,241
Clinton	76,963	Richmond	28
Columbia	210,342	Rockland	3,253
Cortland	351,975	St. Lawrence	90,497
Delaware	259,160	Saratoga	289,478
Dutchess	216,593	Schenectady	195,551
Erie	266,195	Schoharie	222,182
Essex	64,200	Schuyler	143,229
Franklin	26,273	Seneca	175,278
Fulton	100,142	Steuben	297,289
Genesee	296,121	Suffolk	27,399
Greene	192,814	Sullivan	73,298
Hamilton	3,459	Tioga	169,183
Herkimer	333,901	Tompkins	417,757
Jefferson	215,431	Ulster	397,754
Kings	54	Warren	58,772
Lewis	72,198	Washington	189,103
Livingston	242,200	Wayne	509,626
Madison	531,677	Westchester	60,137
Monroe	491,491	Wyoming	323,290
Montgomery	155,861	Yates	143,773
Niagara	255,997		
Oneida	634,262	Total	13,758,353
Onondaga	624,545		

Apple crop of the State of New York, according to the census of 1865, for a few leading counties.

Counties.	Bushels.	Counties.	Bushels.
Cortland	282,423	Ontario	694,572
Madison	365,536	Oswego	376,614
Monroe	498,606	Tompkins	319,925
Onondaga	583,086	Ulster	89,864

Counties in the State of New York producing peaches valued at more than $3,000, in 1854.

Counties.	Value.	Counties.	Value.
Cayuga	$3,346	Seneca	$5,252
Chautauqua	3,702	Wayne	16,174
Columbia	4,224	All others	35,148
Monroe	14,843		
Niagara	11,675	Total	$96,288
Orange	3,752		
Schuyler	3,172	Total bushels	115,410

Counties in the State of New York producing pears valued at or more than $300, *in* 1854.

Counties.	Value.	Counties.	Value.
Albany	$301	Oswego	$432
Columbia	532	Wayne	320
Dutchess	339	All others	3,124
Madison	419		
Monroe	300	Total	$7,375
Oneida	760		
Onondaga	402	Total bushels	7,629
Ontario	443		

Counties in the State of New York producing more than two hundred gallons of wine, in 1854.

Counties.	Gallons.	Counties.	Gallons.
Albany	238	Ontario	959
Cayuga	202	Orange	2,173
Chautauqua	624	Rensselaer	802
Columbia	725	Rockland	497
Fulton	226	Saratoga	734
Genesee	265	Schoharie	210
Jefferson	400	Seneca	550
Livingston	1,563	Tompkins	972
Madison	208	Wayne	681
Monroe	689	Westchester	240
Montgomery	408	Yates	360
Oneida	303		
Onondaga	1,583	Total	15,612

An examination of the foregoing tables of statistics will clearly show that the counties near Lake Ontario are still more favored than are those around the minor lakes, their fruit products being greater in the aggregate, and their rate of increase much in advance. If we arrange the border counties in the order of position, starting from the extreme northeast and following the shore to the southwest, we will observe, as in the table, that the rate of increase from 1849 to 1859 advances in exact accordance with our progress towards the southwest, being least in Jefferson county and greatest in Niagara, with the exception of Genesee, which is separated from the shore by the narrow county of Orleans, until Erie county is reached, which, being least sheltered, has not increased its fruit products in a measure similar to the counties better located. The statistics of these border counties thus confirm the assertion that the modifying influences of the lake waters extend southward from fifteen to twenty miles.

The apple crop of western New York in 1865 was of average amount, but the grape crop near the lake was considered almost an entire failure, the unfavorable weather of June and July conspiring with the August drought, and the short autumn of the district destroyed the hopes of the vigneron.

This district is the favorite home of the apple, as may be learned from what has already been stated; but the pear has not been generally profitable. Millions of trees have been planted, and hundreds of persons have undertaken their cultivation, yet the crop is small in quantity, and not always of first quality. The few that have been successful were planted on a heavy clay soil.

A critical examination of the tabular exhibit of the progress of fruit-growing, as collected for the United States census of 1850 and 1860, illustrates the remarkable growth of this product in certain regions, and its stationary condition in others. Thus, in the Hudson river counties, though many of them are rugged and mountainous, with two exceptions, where but little advance was made, the fruit product increased from twenty to four hundred per cent., with an average increase in the crop of 1859 of ninety-five per cent. on the crop of 1849. In the mountainous counties south of the Mohawk and west of the Hudson, more remote from the latter, and where generally a more rigid climate prevails, one-half exhibited an increase, and one-half a decline in the rate of fruit product, so hat the exceedingly small increase of three per cent. appears. It is probable that the increased facilities of access to market may have stimulated the growth in the river counties beyond the measure due to their climatic advantages.

The counties located around and not distant from the minor lakes present a rate of increase in their fruit product proportioned to the advantages of their position, when compared with those of the latter section, as well as with each other. Their rate of increase varies from forty-three for Cortland to three hundred for Ontario, with an average of one hundred and sixty-five per cent. advance on the crop of 1849. Schuyler being a new county formed from Steuben and Tompkins, these do not exhibit the rates of increase properly their due. The expansion of fruit culture in this favored district is, however, sufficiently marked.

Extending our view to the southern tier of counties, the plateau, which is an extension from northern Pennsylvania and often 1,200 to 1,500 feet high, with deep valleys worn by the head-waters of the Susquehanna and the Alleghany, we find a strong contrast among the series, as well as on comparing the entire region with that adjoining it on the north. While some of these counties have made a great growth from small beginnings, others from an advanced state show an extraordinary decline—so much, indeed, as to throw doubt on the value of the census returns for one county. Thus Alleghany county, from a product of 44,000 in 1849, declined, if we may trust the census of 1860, to $1,263 in 1859. Cattaraugus exhibited a decline of fifty per cent., which is greater than that shown by any other county. The southern tier of plateau counties is, on the whole, compelled to submit to appear as retreating instead of advancing in the march of pomological progress.

In strong contrast to the condition of fruit-growing in the southern border counties is the extraordinary increase of the product of those which border on the great lakes, as shown in the returns tabulated. The least progress was made by the most northern county, Jefferson, Erie ranking next. Both of these are most exposed to winds which flow from the northwest and west, and pass over but a narrow expanse of water before reaching the counties of Jefferson and Erie. Livingston and Wyoming counties are more remote from the waters, and show a much lower rate of increase than the lake-border counties, but much in advance of Erie, perhaps because more under the lee of Lake Ontario. Thus the rate of increase in these lake-protected districts varied from 7 to 721 per cent., and from $456,000 in 1849 to $1,504,000 in 1859.

In a sketch of the horticulture of western New York, by P. Barry, in the Transactions of the New York State Agricultural Society for 1843, he says: "It is shown by correct statistical information that more than 15,000 barrels of apples have been sold the present season in the Boston market from New York at two dollars per barrel, an aggregate of $30,000. This is no inconsiderable item in the products of our State; and yet there are thousands of farmers who have not an apple on their places fit to be eaten at home, much less to be sent to market." How much the farmers of western New York have profited by the above strictures, and those of other pomologists, may appear in the few statistics for 1855 and 1865, which have come within our reach.

"The apple crop of western New York for 1865 was large. The fine weather of September and October was very favorable for perfecting the fruit, and the increased size attained thereby, it is said, added several thousand barrels to the aggregate. Prices ruled high, from four dollars to five dollars per barrel, and many farmers realized more from a few acres in orchard, with little labor, than from all the toil and expense bestowed upon the remainder of their farms. The shipments from one village on the Central railroad, eighteen miles west of Rochester, amounted to nearly 28,000 barrels. One grower alone furnished 15,000 barrels this year. Last year (1864) the same grower supplied from 9,000 to 10,000 barrels, while in 1863 the same orchard produced 35,000 barrels of apples." The apple crop in New England having proved a total failure in 1865, prices were accordingly much enhanced, and the profits of the fruit-growers of western New York greatly increased thereby.

In warm, sheltered situations, within a short distance of the shores of Lake Ontario and the minor lakes, peaches are sometimes produced in great quantities, rivalling, in appearance at least, those of New Jersey, Delaware, and Maryland. The crop, however, ripens late, and it is not until the middle of September that they are abundant. In 1855 nearly $100,000 worth of peaches were raised in New York, much the larger proportion of which were grown on Lake Ontario, and near the lakes Seneca and Cayuga.

That the extraordinary influence of the lakes is limited mainly to the valley in which they lie, is shown by the following sketch of the climate of Canada adjoining thereto, extracted from "Eighty Years' Progress of British America:" "The western peninsula of Canada has its climate greatly modified by the vast lakes which almost surround it. The valley of the St. Lawrence below Kingston, as far as tide-water, is removed from this ameliorating influence. The north shores of Lakes Huron and Superior, and the back country north of a line extending from Lake Huron to Ottawa, and removed from the influences of the great lakes, possess a very rigorous climate, in which the intense winter cold, prolonged through many months, is followed by a short, hot summer, succeeded by genial autumn months."

TEMPERATURE OF LAKE ONTARIO.

It is proposed to demonstrate, from instrumental observation, the influence of these waters upon fruit-growing. The illustrations will suffice for all of the districts near the northern lakes, with some modifications dependent on their extension, inclination, size, and latitude.

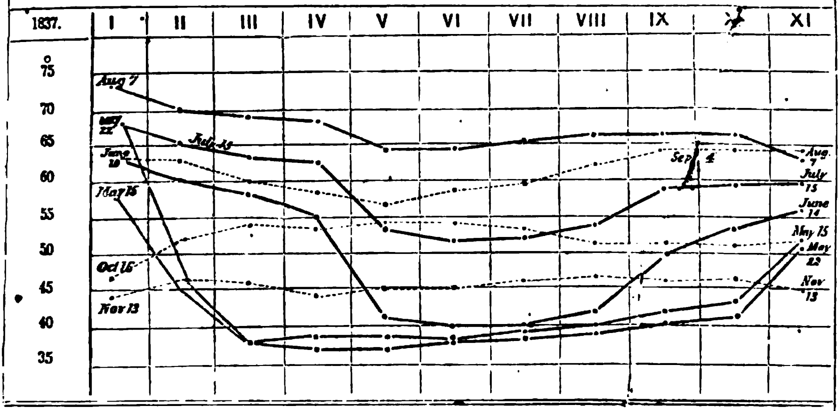
The most complete series of observations on the temperature of the lake waters are those made by request of Prof. Dewey, from the mouth of the Genesee river, on the south side of Lake Ontario, to Coburg on the Canada side, distant, perhaps, fifty-five miles, and nearly opposite on the north. They may be found in the American Journal of Science, (Silliman's,) vol. 33, p. 402. That extended and systematic examinations of the temperature of the lakes at various depths and positions, and at successive dates throughout the growing season, have not been made by the many intelligent and educated local horticulturists, is surprising.

The following observations were made on water drawn from the depth of one foot. The temperature of the water from a depth of three feet was not, however, sensibly different from that taken from near the surface.

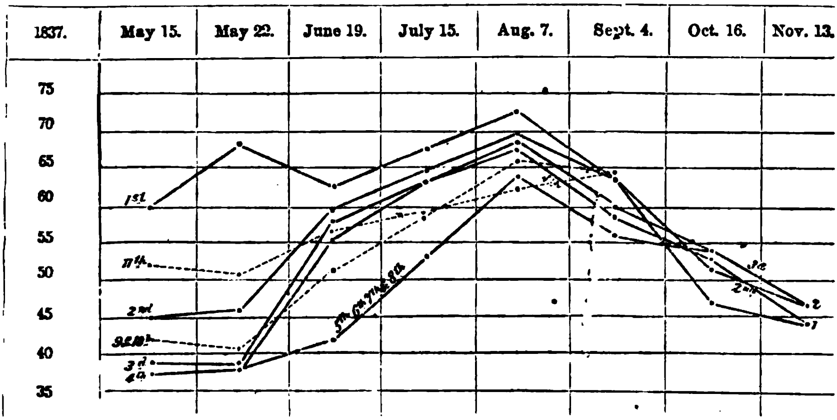
A table exhibiting the temperature of the water of Lake Ontario at one foot beneath the surface, and of the air adjacent, from May to November, 1837.

Station.	May 15.		May 22.		June 19.		July 15.		August 7.		September 4.		October 16.		November 13.		Position of stations.
	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	
1........	60	63	68	66	63	64	68	67	73	73	63	65	47	50	44	45	North of Genesee river, half mile from its mouth. The remaining observations were made at stations distant from 6 to 7 miles apart, except the last, which was made on landing at Coburg, Canada.
2........	45	63	46	77	60	65	65	67	70	72	63	64	52	54	46	38	
3........	39	44	39	44	58	54	63	64	69	74	60	63	54	54	46	36	
4........	37½	52	38	40	55	58	63	65	68	72	58	63	53	53	44	38	
5........	37½	48½	38	41	42	55	53	63	64	71	57	60	54	56	45	38	
6........	38	54	38	39½	40	54	52	63	64	72	58	59	54	59	45	36	
7........	39½	55	38	40	40	50	52	62	65	73	59	59	53	57	46	36	
8........	40	54	39	44	42	55	54	64	66	73	62	63	52	57	47	33	
9........	42	55	40	45	50	62	58	67	66	73	64	65	52	56	46	32	
10........	44	55	42	49	53	63	59	68	66	73	64	65	51	54	47	33	
11........	52	54	51	54	56	64	59	68	63	72	64	63	52	54	45	40	
Wind	South.		Northwest.		South.		Northwest.		Southwest.		Northwest.		Northwest.		North.		Remarks.
	....	70	....	59	....	62½	....	68½	....	74½	....	56½	....	46	....	38 1-6	Mean temperature of the day of observation.
	....	71.6	....	57.2	....	59.6	....	74.8	....	62.5	....	56.5	....	46.6	....	46.5	Mean temperature of two preceding days.

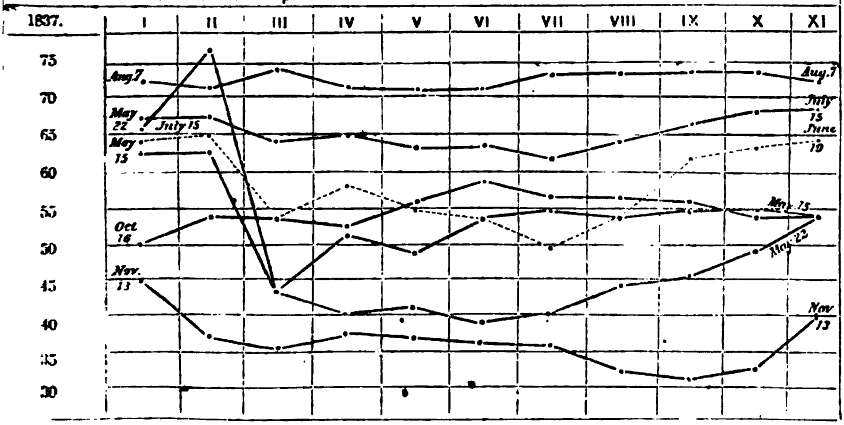
Curves of temperature of water observed at successive stations across Lake Ontario from Rochester to Coburg, from May to November.



Curves of temperature of water observed at each station between Rochester and Coburg, about 6½ miles apart, from May to November.



Curves of temperature of air observed at the above stations.



The accompanying curves of temperature for each series of observations, conducted across the lake, will exhibit the variations in the heat of the surface-waters as the season advances.

Thus from May 15 to August 9, the temperature at the mouth of the Genesee, where the waters from the land predominate, is higher than at any station across the lake, or on the Canadian shore. At the second station, half a mile from the mouth of the Genesee, where its waters are well mingled with those of the lake, the temperature in May rapidly declines to 45°, and continues to descend, for thirteen miles beyond, until it reaches 37½°, which it retains with a very slight rise to 38°, 39½°, and 40°, to within, perhaps, fifteen miles of the Canadian shore, when it suddenly rises to 52°. On May 15th and 22d, a close parallelism is maintained throughout the line of observations, showing that the warming influences of the sun's rays upon the land waters have not reached their highest activity. By June 19, this action has begun to show its effects on the shore waters, though those in mid-lake are yet scarcely changed. This central channel is chilled, no doubt, by the influx of the cold waters of the upper lakes, and the accumulations of ice near the outlet of Lake Erie, which frequently do not disappear until some time in May. The shallow waters of Lake Erie, which are closed to navigation in December, and continue more or less frozen until March or April, have an effect in retarding the "warming up" of Ontario to a marked degree. These cooling agencies removed, the action of the ordinary law of heat, exchange, and restoration of equlibrium comes into action. On July 15, the shore waters, for thirteen miles out, are nearly as warm as those but half a mile distant, where they suddenly descend to 53°, a fall of 10° in seven miles. This they retain with slight decline until on approaching the northern shore they rise to 58°, and reach 59° at Coburg. The curves of temperature taken across the lake are thus losing, at every new series of observations, their extreme curvature, and becoming more rectilinear, until, in August, they are but slightly deflected in mid-lake from the average temperature for that month entirely across. In August, a maximum has been reached at the mouth of the Genesee river of 73°, and 70° half a mile distant therefrom, though at Coburg the highest water temperature is now but 63°, thus giving at the height of summer ten degrees of warmth to the New York, over that of the Canadian shore. The temperature of the air by day, is, however, nearly the same at these places through June, July, and August, descending, in mid-lake, 14° in June, 5° in July, and but 2° in August above the measure observed on the extremities of the line near the shores.

A reverse order of changes takes place in autumn. In early September the temperature on the southern shore declines nearly 10° below that of August, and retains this lower measure of 4° to 7° until within twenty miles of the Canada shore, where it has declined less rapidly, and is 1° higher at Coburg than in early August. In October, or by the 16th of that month, a greater change has come over the curve of temperature across the lake, as noted at the surface. The waters of the Genesee are now 5° colder than the lake half a mile distant, and 7° colder than waters seven miles therefrom. This temperature of 53° or 54° at seven miles distant, they retain beyond the middle of the lake, and decline gradually to 52° and 51° on the northern shore, maintaining thus, a nearly uniform temperature from side to side.

In the middle of November the surface waters throughout have an average temperature of 45½°, varying but 1½° from this mean, and that at the mouth of the Genesee, is 1° lower than on the Canadian side.

The temperature of the air in contact with the waters of Lake Ontario varied, of course, according to the prevailing winds. In May the air over the mid-lake was 1½° to 16° higher than the surface waters; in June, 3° to 14°; in July, 9° to 10°; in August, about 8°; in September, 0° to 3°, and in October, 0° to 5°, while in November the waters stood 6° to 10° in mid-lake, and 14° higher than

the air above them over much of the remaining distance to near the northern shore. The highest atmospheric heats were in August, 73° and 74°, while the waters were but 66° and 69°, with a southwest wind; the lowest, 32°, in November, near the northern shore, while the waters were then 46° at the surface. An exceptional high temperature of 77° is recorded in May at half a mile from the Genesee, though the waters were then 46° and the mean for the day 59°, and that of the air at the river's mouth but 66°; this may be erroneous. The foregoing will serve to interpret the diagram of curves of temperature regarded as progressing geographically across the lake. The following explains the relative changes which take place at each station as time advances through the season: From May 15 to May 22, one week only, a rapid rise is noted at the mouth of the Genesee, from 60° to 68°, followed by a decline to 63° in the middle of June, which last is due to the influx of the colder waters of the upper lakes. By July 15 the temperature has ascended to that of May 22, and advances in August to 73°, which is not reached at any other station; declines now rapidly to the middle of September, and precipitately thence to the middle of October, when it has reached 47°, and to 44° in November, when observations ceased.

A general *résumé* may conclude this extended and detailed elucidation of the lake and air temperatures and their mutual relations. In winters the vapors rising from the lake fall in rain or snow almost daily over a belt of country extending from 6 to 10 and sometimes 20 miles inland, thus keeping the region almost constantly under a cloud and shielding from loss of heat. From the 6th to the 10th of January, 1866, a period of excessive cold throughout the northeastern part of the United States, the cold came slowly on, borne by no strong wind or storm to reduce the temperature suddenly; consequently the vapor was wafted over Rochester from north and north of west, and the extreme observed was 5° to 15° higher than at places 20 miles distant from the lake.

In the spring the vapor continues to come off towards the south, and as the water does not cool down to 36° until March, its vapor clouds the shores by night and prevents frosts or causes light rains, so that for 8 or 10 or 15 miles inland peaches may escape the cold so often destructive at many places before their blossoming time; apples and pears also are favored at their season of bloom, and an admirable fruit region is obtained as many miles wide as these vapors or rains extend inland. The same agencies prevail through the summer season, when the midsummer heats raise additional vapors to be borne by the cooling north winds over the lands parched by drought, arrest the too rapid cooling during the dry nights of June and July, and shelter the tender fruits from the excessive cold, which frequently, in conjunction with an arid atmosphere, destroys the fruit crop generally throughout the land. In autumn the moderate heat acquired by the summer warming, which has probably reached the depth of 100 feet or more, is gradually given out; the lake having attained a nearly uniform temperature over its entire surface, its warm vapors, still borne by the northerly winds over its southern shores, prolong the growing season and prevent the access of early frosts. This longer autumn, though favorable to the maturation of apples, is not sufficiently warm near the lake shore for perfecting the better class of grapes.

Lake Ontario is so large and so deep that it never freezes in winter to any great extent. The ice formed along the shores is soon broken by the waves, and is only formed in any considerable quantity very late in the winter, after a long season of cooling, and when the surface has been unruffled for some days. The temperature of the entire lake waters can never be reduced to 32°, as by some supposed; for, owing to a law, now believed to be general, that bodies shall expand as they approach the point of congelation, the maximum density of water is not at 32° but at 39°.2 Fahrenheit, and after passing the latter point it expands until it freezes, and thus, though colder, floats upon warmer waters. The surface

waters therefore cool until they reach 39°.2, and, having thus become heavier, sink and are replaced by warmer waters to undergo the same process until the whole mass is cooled to 39°.2. After this the surface waters may congeal, because being now specifically lighter, they must float and continue exposed to radiation. Ice being a poor conductor of heat then acts as a protector, and the waters beneath are shielded from rapid cooling, so that during the coldest winter a thermometer indicates but 39°.2 Fahrenheit if sunk a few feet beneath the ice. Were this law not operative, ice would form first at the bottom of the lakes and ponds, and gradually accumulate until the whole would become a frozen mass which the hottest summers could not thaw.

THE FRUIT DISTRICT ON THE SOUTHERN SHORE OF LAKE ERIE.

The southern shore of Lake Erie presents one of the most interesting evidences of an extended district wherein the local climate is much modified by the immediate presence of water.* The grapes of Kelley's island and vicinity are so well known and esteemed as to render it almost superfluous to refer to them as evidence of the capabilities of the district. By enthusiastic residents the country bordering the west end of Lake Erie is pronounced the best as respects climate and soil for the production of the grape and some other delicate fruits to be found east of the Rocky mountains. In this opinion there appears to be strong reason to coincide, for while the fruits here produced have generally excelled in flavor and fairness all with which they have been properly compared, the certainty of a full crop annually seems to admit of "no such word as fail." For many years the crop of grapes was as certain as a crop of corn, none of the impairing or destructive pests of mildew or rot having seriously affected the fruit or leaves, though raging destructively in distant districts.

For more than twenty years prior to 1865 there had been no failure of the grape crop at Kelley's island and district adjoining. In the latter year, at many places on the southern shore, the season was unfavorable both for the fruit and the vines, but the injury was by no means as extensive as has been reported. It is said to have arisen in a measure from the effects of hot sunshine alternating with frequent showers, and was most apparent on sandy soil, which is here deemed less favorable than a heavy loam.†

It is no new thing to suffer to some extent on unfavorable soils from mildew and the residents of Kelley's island and the adjoining district do not claim for it entire exemption from either leaf blight or rot. Long experience has shown, however, that when the grape crop is indifferent throughout the northern States generally, here it is very good. When it has been entirely destroyed elsewhere, here it has been of moderate amount and quality, or equal to its best years in both respects. The year 1865 was an illustration of both of the latter conditions; throughout the east and the west, almost everywhere, except immediately along the Hudson, near the minor lakes, on the islands of Lake Erie, near the Atlantic ocean, in New Jersey, and perhaps near Lake Michigan and on the borders

* The belt of lake shore on the south side of Lake Erie adapted to vine-growing is regarded as extending from Dunkirk and Fredonia, in New York, to Port Clinton, in Ohio, including the islands and peninsula near Sandusky. This belt is 200 miles in length with an average breadth of about 5 miles, over most of which the grape is found to flourish and ripen remarkably well. Within this belt, according to excellent authority, that of M. B. Bateham, secretary of the Lake Shore Grape-growers' Association, there are about 8,000 acres planted with grape vines. These are all included within six counties which border the lake. About 1,000 acres are planted with vines around Cincinnati, and 1,000 acres on the Ohio hills eastward and in the interior of the State.

† William Griffith, one of the pioneers in grape-growing, stated at the fruit-growers' meeting at Rochester, New York, in June, 1866, that he had, in 1865, a crop of Catawbas weighing three tons to the acre, and had raised a crop every year, except one, for 20 years past. His vineyard is almost at the extreme eastern end of the favored belt or wine region of Lake Erie. This experienced grower prefers a dry, hard, forbidding soil for grapes.

of the Mississippi, the Catawba, Isabella, and Delaware were an almost total failure. That the Catawba and Isabella were successfully grown in the districts under consideration is proved by the display of grapes at the grape-grower's exhibition at Sandusky in the autumn of 1865, as well as by abundant testimony of reliable private correspondents. This display was pronounced "magnificent," whole canes loaded with enormous clusters as well as detached bunches having been exhibited, mostly Catawbas and Isabellas.

From a report made by F. R. Elliott to the northern Ohio and Lake Shore grape-growers' association, we learn that the wine made in the section of the wine region east of Cleveland in 1865 amounted to 40,000 gallons, in the section west of Cleveland to 150,000 gallons, and in the immediate vicinity of that city to 89,000 gallons, making a total of 279,000 gallons of wine, valued, at wholesale prices, at between $500,000 and $600,000. Had the entire crop of 1865 been converted into wine, the product, according to the estimate of the same observer, would have amounted to the immense return of 2,000,000 gallons—ample evidence of the continued fruitfulness of the vine in this favored district.

The experience of grape-growers at Kelley's island, near Sandusky, Ohio, having proved highly satisfactory for many years past, the climate of the district would seem to furnish a proper measure with which to compare or contrast that of other regions. Meteorological observations have been made on the island with minute attention to accuracy for seven years past, and on the lake shore and further inland for a longer term.

These observations, so far as they can be employed for comparison, confirm the assumption that a certain regular march of season or difference in the temperature from month to month is demanded, accompanied by a high degree in July and August, or if not present in August, then in September, with a more rapid decline towards the end of the latter month to October without frost. Unfortunately one of the most important criteria of climate has been neglected; that is, the amount of invisible vapor in the atmosphere or the relative humidity during the growing season. But as respects temperature, the results of comparison are highly interesting and instructive. The assumption that the percentage of vapor in the air, or properly its relative humidity, at Kelley's island, is in excess of that at places distant from the lake shore, or at those immediately thereon, in general, is highly probable.

The following tables may serve to illustrate several peculiarities of the climate of Kelley's island and enable the reader to compare the mean temperature of several years past, as well as to contrast them with those observed at places near the southern shore of Lake Erie and more remote and beyond its influences:

Mean temperatures observed at Kelley's island for seven years, with progressive increase or decline from month to month.

Year.	May.	March of temperature.	June.	March of temperature.	July.	March of temperature.	August.	March of temperature.	September.	March of temperature.	October.	Quality of crop.
	°		°		°		°		°		°	
1859.......	60	+ 4½	64½	+ 8½	73	— 1	72	—10	62	—12	50	
1860.......	61½	+ 7	68½	+ 2 1-6	70½	— ½	70½	— 9½	61½	— 7½	53½	
1861.......	53½	+ 15½	68½	+ 2	70½	+ 1½	71½	— 5½	65½	— 9½	55½	Superior wine made.
1862.......	56½	+ 8	64½	+ 8½	73	+ ½	73½	— 6½	67	—12½	54½	Much rot, but remunerative.
1863.......	60	+ 6½	66½	+ 5	71½	+ 1½	72	— 9½	62½	—12½	50	Excellent crop of grapes.
1864.......	60	+ 9½	69½	+ 6½	76	— 1	75	—10½	64½	—13½	51	Excellent crop of grapes.
1865.......	59½	+15 1-6	74½	— 3	71½	+ ½	72	+ 1	73	—19½	53½	Greatest crop and best wine.
1866.......	56½	+ 12.8	69.11	+ 8.5	77½	— 8.6	69	— 6	63	— 6.8	56.2	
Means...	58½	+ 9½	68	+ 5	73	— 1	72	7 1-6	64½	—11½	53	

	Mean monthly temperatures.							Lowest temperature at 7 a. m.							Frost.
	May.	June.	July.	August.	September.	October.	November.	May.	June.	July.	August.	September.	October.	November.	
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	
1863.															
Monroe, Mich.	63	66	71	71	60	47	42	38	48	50	50	36	30	20	
Toledo, Ohio	63½	62½	74½	73	61½	45	44½	41	51	51	48	33	31	17	
Kelley's island	60	66½	71½	72	62½	50	43	40	52	56	52	42	39	19	November 1 to 10.
Cleveland	62	66½	72 1-6	73½	62½	51	44	42	53	57	49	40½	34	18	
Norwalk,	60½	64½	69½	70½	59½	47½	41½	41	46	50	45	38	29	16	October 12.
Austinburg	59	63	70	70	58	46½	40	38	49	52	41	32	25	16	
Welshfield	62	65	71	71	60	46½	40	41	52	52	47	37	27	12	
Cincinnati	67	71	77½	72	65	49½	43½	44	58	61	45	38	31	12	
1864.															
Monroe, Mich	62	68	74	?	61	47	39	36	50	62	?	45	29	15	
Toledo, Ohio	63 1-5	70½	75	71	61½	48	40½	37	50	60	49	45	28	13	
Kelley's island	60	69½	76	75	64½	51	41	37	51	65	60	50	35	18	
Cleveland	60½	62½	75	73 1-5	63	50½	42½	39	51	61	55	50½	36	18	
Norwalk	59½	67	72½	70½	61½	47½	40½	33	48	56	50	44	32	14	October 9.
Austinburg	?	65	74	72	58	51	39	?	38	57	52	44	30	12	
Welshfield	60	68	74½	71½	61	47	39	33	43	56	51	46	33	16	
Cincinnati	64	75	79½	76	66	50	44	33	53	57	57	44	33	13	
1865.															
Monroe, Mich	59½	74	68	68	69½	48½	39	40	54	52	50	51	31	25	October 1.
Toledo, Ohio	59½	73 1-5	69½	68½	70 1-5	50 1-6	41	39	54	55	53	46	32	26	October 2.
Kelley's island	59½	74½	71½	72	73	53½	43	39	60	58	59	57	38	32	November 5.
Cleveland	58	73½	70	69½	69½	51½	41½	40	54	50	47	49	33	16	
Norwalk	59	72½	69	67½	69½	48½	39½	34	56	52	50	52	30	23	October 6 to 31.
Austinburg	58	71	70	67	?	46½	38½	30	57	53	46	?	24	20	October 13.
Welshfield	58½	73½	69½	69	?	48	40	36	56	54	50	?	32	20	October 13.
Jamestown, N. Y	57½	71	67	67	?	?	?	36	55	52	48	?	?	?	
Buffalo	56	70	70	68½	?	48	40½	38	55	45	49	?	26	23	
Cincinnati, Ohio	63	78	75	74	?	54½	43½	41	63	57	53	?	32	28	October 3.

The observations from which the first of the above tables was constructed were made by George C. Huntington, an experienced meteorologist and grape-grower, resident on Kelley's island. Much of the material comprising both of these tables has not been heretofore published, but was derived from the private contributions of the various intelligent meteorologists residing at the stations whose monthly means are noted on the tables. These stations extend from the western head of Lake Erie to its eastern extremity and outlet. That their position may be better defined, it should be stated that the first station at Monroe, Michigan, is on the river Raisin, four miles from its mouth, and Toledo on the Maumee river, the same distance from the lake, and both near its head. Kelley's island is not far from Sandusky, Ohio. Norwalk lies south by east of Sandusky, on a sandy ridge, ten miles from the lake. Cleveland is on the shore, one-third of the distance from the head to the foot of the lake. Austinburg lies ten miles inland from Ashtabula harbor, and about midway of the line of the lake shore. Welshfield, in Geauga county, is about twenty-five miles inland from the harbor above named. Jamestown is situated in Chautauqua county, New York, near the head of the lake of that name, and twenty-two miles inland, near the foot of Lake Erie, while Buffalo lies at the extreme end and outlet.

On examining the table of Kelley's island mean temperatures, it will appear that the column for May exhibits a remarkable uniformity, the mean having been 60° or thereabouts for five of the eight years reported. That for 1861–'62–'63 fell below this mean; but the former only was much below the average. This similarity of means for May is evidently due to the uniform temperatures of the cold waters of the upper lakes, chilled by the melting ice of Huron, or from beneath the yet unthawed surface of Superior. As the upper portion of the lake which surrounds the islands is shallow, having a nearly level bottom, with an average depth of thirty feet, the icy waters of the upper lakes at once affect the temperature of the air above it, and continue to temper it, while thawing, to a considerable extent, is going on in the colder lakes, whose waters flow through it. Again, the temperatures for June present a striking similarity, from year to year, throughout the term of seven years, that for 1865 being a remarkable exception. These temperatures advance at a certain moderate rate over those of May, varying on both sides of a mean of 7°, except in the years 1861 and 1865, when this advance was remarkable, and reached about 15°, a march of temperature which proved highly destructive in some districts, and was somewhat injurious at Kelley's island. The increase of mean heat reached in July, as compared with the mean of June, would average about 5°; but, in 1865, a decline of 3° occurred. The mean temperatures of July and August are remarkably uniform, presenting an average variation, for seven years, of less than one half of one tenth of a degree, and of but one degree for the eight years noted, and in no year varying more than 1¼ degree from the mean, except in 1866, when a remarkable decline was apparent. Thus, if the heats of July are high, they are continued through August, followed by a moderate decline to the mean for September, also of much uniformity from year to year through seven years; but in 1865 presenting the extraordinary instance of a rise of one degree, or a warmer mean temperature in September than was experienced in July or August of that year. This high temperature proved highly advantageous to the grape crop, and caused, in conjunction with a warm October without frost, the production of the greatest crop and the heaviest must* ever known at Kelley's island. The un-

* The value of the continued high heats of autumn, and the consequent perfect maturing of the grape, is especially recognized in the richness of the must, or the newly-expressed juice of the grapes, grown on Kelley's island, as compared with that of other localities. Thus, by Oechsle's must-scale, the must of the island grapes is generally at 90° to 92°, and has been observed to reach 100°, which last is equivalent to about 24 per cent. of sugar, and fitted for the production of wine of the first quality. The must prepared from grapes grown at Cleveland or Sandusky is reported to weigh from 75° to 80° on the same scale, and may

towardness of the early season was thus counterbalanced by the extraordinary and prolonged autumn.

The march of the seasons is thus shown to be remarkably uniform, indicating the action of some great equalizing agency which maintains its steady influence from year to year, with rare exceptions. These exceptions, more or less injurious, in their results at Kelley's island, occurred, as we have observed, in 1865, and serve to show wherein the value of the former climatic arrangements consisted. In the season of 1865, though the normal mean of about 60° appeared in May, that for June was an abnormal advance of 15¼°, and reached the high mean of 74½°, which is not commonly known till July. This high heat, which prevailed throughout the northern and western States, with abundant rains, stimulated the growth of wood and foliage as in a semi-tropical clime. This extraordinary growth and succulency, followed by a reduction of temperature, for July, of nearly 3°, and below the average of years of excellent product, and a continuance or increased fall of rain in July, could but prove unfavorable to the healthy development of the vine, and the timely elaboration of the elements, on the presence of which depends the value of its fruit, and fears were entertained for the safety of the crop.

That this decline from June to July was general from the head to the foot of the lake, where it disappeared, and that it was attended by extremes which varied still more, may be seen by the table of comparative temperatures of places along the lake shore. At Monroe a fall of 6°, and at Toledo of 4°, was noted, while the minima, or lowest temperatures, for July, at 7 a. m., exhibit the remarkable measure of 58° on the island, when 50° was observed at Cleveland, and at other places 52° to 55°.

It is true that these unfavorable conditions were attended by average July and August means at the island, where, indeed, the best success was reached; but on the south shore of the lake, from Toledo to Buffalo, the August mean was 3° to 5° lower than the average in favorable seasons, and the minima were again reduced below those at the island, and still lower than that of July, while the island minimum for August was higher than that of the preceding month. At Cleveland this lowest temperature, at 7 a. m., was 47°, a destructive measure for August, indicative, as it is, of a still greater extreme during the night, at hours when observations are not recorded. Accordingly, along the shore of Lake Erie, the grape crop suffered materially. The same causes operating over almost the entire northern section of the Union, brought with them destruction to the grape, and, in many instances, to the vine, wherever the high heats of June and abundant rains with a subsequent marked decline of temperature and excessive drought prevailed, and to these conditions there were few exceptions. On Kelley's island the change was less extreme; the temperatures by night did not decline to an injurious degree, and the crops escaped material damage.

THE SEASON OF 1866.

The year 1866 exhibited wide departures from the mean temperatures and extremes of temperature generally observed, having been remarkable for extraordinary heat and cold; even the favorable surroundings of Kelley's island did not entirely protect the vine from these untoward influences.

The winter of 1865–'66 was extremely cold, both in the east and west. In December, 1865, the low temperatures of from 4 to 22 degrees below zero were observed over northern Illinois, Wisconsin, and Iowa, while the heats of July over the same region were 95°, 100°, and 104°. In January, 1866, the cold was

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contain from 15 to 17 per cent. of sugar; on the sandy soils, 65 to 70 per cent. is esteemed good on the lake shore. At Cincinnati the must varies from 75° to 90°, or from 15 to 20 per cent. of sugar. The highest measures above noted were observed at Kelley's island in the favorable autumn of 1865.

excessive on one day over New England, New York, Pennsylvania, and New Jersey, the extremes observed at 7 a. m. having been the lowest ever before recorded. Thus—21° in Massachusetts—25° in Connecticut—28° in New York, and—12° in New Jersey, are very extraordinary; though the true minima, indicated by a self-registering thermometer, were from 2 to 5 degrees lower than the above.

The heats in July were equally abnormal and oppressive in the eastern States. The first half of July was the hottest observed at Rochester, New York, for 30 years past; at Newark, New Jersey, no July for 23 years had had a higher mean; and for 40 years Philadelphia had not known a hotter period, if, indeed, any so extreme had ever before been known. Five stations in Pennsylvania recorded the temperature, at 2 p. m., at 100° and 101°, and several others 97° to 99°; in New Jersey, three stations noted 101° and 102, and seven 97° to 99°; in New York, four recorded 100° to 102°, and six 97° to 99°; in Connecticut and Massachusetts, 100°, 102°, and 103° were observed, and in Vermont 106° appears to have been reached. The high temperatures were mostly observed on the 16th or 17th of July. In Ohio, 98° and 100° were recorded at several stations; and Indiana, Illinois, and the northwest were oppressed with the same extreme heat, though in general a few degrees less excessive. In some places in New Jersey, no day entirely cloudy was observed in July; and 102° was observed at Haddonfield and Moorestown, and 99° at Seaville, on the Atlantic coast, near Cape May.

In some districts the drought of July was excessive, while in others the rainfall was very heavy and frequent. This was especially the case in Utah, a very unusual occurrence at this season, in Kansas, Missouri, Iowa, Illinois, Kentucky, Indiana, and southern Ohio. But in June the clouds were emptied upon Kansas, Minnesota, northeastern Ohio, the lake shore, and northern New York. On the lake border of Ohio the fall of rain was the greatest recorded for many years. The storm accompanying was the most severe ever known at this season, and the destruction of property on the lake was very great. Upwards of 10,000 sheep, it is said, perished in Erie county, Ohio, alone, from the effect of the wet and cold, consequent upon exposure after shearing.

The Isabella and Catawba vines blossomed at Kelley's island on the 21st and 24th of June, from one to four days later than their hitherto uniform appearance; and as they flowered irregularly, and some of the berries were formed before the blossoms opened on other parts of the same raceme, they ripened unevenly, and the crop was impaired in beauty and value. It has been repeatedly observed that the best grapes follow blossoms that appear at the same date, when the weather is warm and dry.

The mean temperature of July, 1866, at Kelley's island, was 5°.17 above the mean for seven years preceding, and nearly 1½° above that of the warmest July (that of 1864) hitherto recorded; while that of August was far below the usual mean for that month, and frosts were known in the interior of Ohio. The lowest temperature at Kelley's island, in August, was 55°, while at sundry places in the interior, beyond the lake influence, it fell to 42°, 47°, and 48°. The temperature of Lake Erie, on the first of August, rose to 75°, the mean of several years past; and presented a barrier against frost on the island which it surrounded. At many stations the cold of August, 1866, was observed to have exceeded that before on record. At Newark, New Jersey, the mean temperature was nearly four degrees lower than had been observed for 23 years; and at Rochester, New York, and Steubenville, Ohio, it was colder than had been noted for 30 years, the period over which the records extended. In some places it was six degrees below the general average for the month, and at others it was wet and disagreeable, and frost was seen at many places in Massachusetts, New York, Pennsylvania, Ohio, Michigan, Indiana, Illinois, and the northwest.

Extremes so great could not fail to prove injurious to the vine, or to its prospective crop of fruit. Accordingly, we find it to have been greatly injured by

the cold of January, on the Atlantic border, by the heat and drought at some places, by heavy rains at others in inland districts, and that it did not entirely escape damage on the lake shore of northern Ohio. At Kelley's island the crop was much smaller than that of 1865, which was, however, perhaps the greatest ever grown.

Such a combination of adverse influences as above noticed may not occur again in a series of many years; but, in the opinion of observant men, there is operating, at Kelley's island, an influence which will continue to impair its fitness for grape-growing.

The following, from an observant and highly intelligent gentleman, long resident in this region, is worthy of record and attentive consideration:

"Your observations on the effect of destroying all the forest trees, still too much the custom among our farmers, coincide so exactly with deductions from my own experience, that I felt more fully confirmed in the assurance I have entertained of their truth for many years past. When I first came here to reside, in 1838, we planted apple, peach, pear, and all the finer fruits we had been accustomed to in the east. For a number of years all went well; the country afforded us fine peaches, and the crop was *sure*. But when the island began to be famous for its grapes, the demand for land rendered it too valuable for the growth of timber. It was accordingly divided into lots of one to twenty acres, and was, of course, stripped of every forest tree to make room for the coveted vine, and even the division fences were removed. The consequence of this stripping has been that the peach trees have wholly disappeared, being unprofitable; most of the apple trees have been rooted up; the plums and cherries have gone with them, and scarcely anything is grown, where the soil is deep enough, but *grapes, grapes*. These have, until within a few years past, been all that could be desired; but we cannot but conceive that it is probable that the same causes which have almost annihilated our ordinary fruits, may, in time, affect the grape crop in like manner, and I do verily believe that it would ultimately pay to surround every vineyard of ten acres with a stone or brick wall ten feet high, or that the results of this protection would, in ten years, fully refund the outlay through the increased value of the crops."

THE WESTERN SHORES OF LAKE ERIE.

That the lake shores were favorable to fruit-growing had long been known, though we have been slow to profit by the knowledge, as applied to the grape. In 1866 the largest crop of apples in Ohio was raised on the western reserve, or the line of counties bordering on, or not distant from, the southern shore of Lake Erie. The crop was deficient, even in western New York; yet, from the above favored region, many thousands of barrels of apples were shipped to Chicago and New York, at remunerative prices. The quality was also superior. The western extremity of Lake Erie, and the shores of Detroit river, were favorite locations with the early French settlers. Near Detroit and Monroe, Michigan, there still exist many old orchards of apples and pears planted by these pioneers, which are, at the age of a century or more, vigorous and productive, showing, unmistakably, the strength of the soil and the geniality of the climate. Many of these pear trees have continued healthy and attained magnificent dimensions. On the banks of the Detroit river there are trees now standing nearly two centuries old, lofty and beautiful, lining both margins, in Michigan and Canada. These trees, though planted in 1675 or 1680, are often loaded with fruit to this day. A rather moist, tenacious soil, readily permitting a natural drainage, appears most favorable to the pear; but contiguity to a large body of water, whereby the severity of winter cold is lessened, and protection in summer from excessive heats, afforded by a humid atmosphere, is doubtless the most important condition to which these trees are indebted for their freedom from disease and their great longevity.

The valley of Raisin river, noted for its beauty and fertility, retains to this day the peculiar merits to which it owes its cognomen. At the city of Monroe, distant four miles from Lake Erie, the grape crop of 1865 was uninjured by mildew or other blights. The Delawares were fine, and the Diana, which fails to ripen in short seasons, matured well in the long autumn. The Catawba was also very fine in partly sheltered places, but is not reliable in the open ground, as the western borders of the lake are less favorable to its ripening than are the islands on the southern shore.

An observant lady correspondent informs me that many acres of the bay's shallow lagoons, at the western extremity of Lake Erie, are covered with *nelumbium luteum*, the sacred bean of India, or, more properly, the Egyptian lotus, a magnificent water lily. The existence of this plant in western Lake Erie more clearly demonstrates the high summer temperature of its waters at its shallow extremity than anything I could adduce. The yellow Egpytian lotus requires almost tropical heats to bring its rare beauties to their height; yet here, in this northern region, 140 miles north of Philadelphia, it attains dimensions unknown elsewhere in the same latitude, or, indeed, in regions that can boast several degrees "of more indulgent skies." The corolla of this queen of American plants, on the shallow bays of western Lake Erie, attains a diameter, when fully spread, of twelve inches, and ripens a torus, or seed-pod, six inches across.

On comparing the monthly means, and the highest and lowest daily temperature observed at regular hours at Kelley's island, where grape-growing is always successful, with the same elements of climate as noted at Haddonfield, New Jersey, where success is the exception, we find that in 1864 and 1865, which were very unfavorable seasons at the latter place, a remarkable accordance appears in the several particulars. The register minimum thermometer indicated lower extremes at Haddonfield than were probably known at Kelley's island at the same time, as it is asserted that, at the latter place, the temperature by night scarcely descends below the means at 9 p. m. and 7 a. m., retaining a remarkable uniformity during the night. The absence of dews in the morning is a note-worthy accompaniment of the lake-shore climate, the night temperature seldom falling, for weeks together, to the point of dew deposition. This is expressly shown by the remark of a lady informant, that, at Kelley's island, "the ladies can often cross a grass plat, at early dawn, without moistening their slippers." That this is not the result of deficient atmospheric moisture is well understood, but a consequence of the slight reduction of the night temperature below that observed by day; and herein lies the secret of success in this favored region. Not so in the region around Philadelphia, six miles southeast of which our observations were made. Here our extremes by night have proved destructive for several seasons past, while our droughts also offer strong contrasts to the perpetual humidity of the air of Kelley's island, and are, we believe, one of the causes predisposing to the frequent appearance of these fatal extremes, while the dry atmosphere attending is itself highly injurious to the vine. (For further remarks pertinent to this branch of the subject, see "Observations on Atmospheric Humidity," in Agricultural Report for 1865, pp. 520–550.)

THE AGENCIES WHICH AFFECT THE SOUTHERN SHORE OF LAKE ERIE.

The southern shore of Lake Erie, with its islands, is, perhaps, the most extended and favored fruit district in the northern United States. This lake differs in several particulars from the other links of the great chain, and as the peculiar value of its shore depends directly thereon, an explanation of the causes which here act conjointly, and more favorably than elsewhere, may be in place. Lake Erie is the most southern of the great lakes; the latitude of its southern shore, therefore, gives it advantages the others cannot enjoy. It is the shallowest of the lakes, and, moreover, is of various depths, from 30 feet at its upper division,

to 84 in its middle reach, deepening to 120 at its lower or eastern portion, near its outlet. It is so placed, as respects its upper neighbors, as to receive their cold waters in the spring over its shallowest depths, giving, through their retarding influences, a high northern latitude, and to collect the warmed summer waters, and retain them near the surface for further heating, by which all the benefits of a hot southern latitude are secured, and with them a prolonged autumn. Its whole mass is more readily warmed than that of the other lakes, while the varying depth influences successively the temperature of its shores, as is shown by the gradual decline of summer heats, and the later appearance of autumn frosts, progressively from its shallower upper portion to the deeper outlet. The other lakes are of greater depth, are not so favorably situated as respects latitude and relative position, and their effects are not so valuable as those of Erie, as may be illustrated in the case of Ontario. The uniformity with which the waters of Lake Erie reach a definite degree, at stated periods, is remarkable, and worthy of record.

In the spring the ice in the lake and the coldness of the waters from the late-melting ice of the upper lakes usually so affect the temperature along shore that vegetation does not start as early as more inland, and fruit trees may be in blossom and salads upon the tables of Cincinnati and Columbus before any signs of spring are perceived at Cleveland. But in return for this, the southern and central parts of the State must often lament the loss of their fine prospects by the visit of a destructive frost, from which the lake shores are entirely exempt. While spring has thus prematurely opened in the southern districts of Ohio in March, it awaits on the lake shore the movements of the ice; nor does it awake to activity as long as considerable bodies of ice float in the waters even as far down as Buffalo. When the ice has disappeared and the waters a few rods from the shore have risen to 42°, and the body generally to 40°, vegetation begins to put forth rapidly, and frosts seldom occur thereafter to injure the tenderest plants. On Kelley's island this occurs about two weeks later than on the main land. An interesting illustration of the ameliorating influences of the lake, by which it protects vegetation through its clouds or mists, may be adduced from the observations of Dr. Kirtland in the report of Ohio State board of agriculture, 1858: "On the 1st of May, 1851, spring seemed fully established, fruit trees had blossomed and in some places young fruit had been formed. The morning was cold and the temperature declined during the day and evening. At 2 p. m. it was 48°; at 7 p. m., 34°, and at 9 p. m., 32°. The atmosphere was calm, indicating to an experienced observer the approach of a destructive frost. At 10 p. m. the thermometer had risen to 40°, a heavy cloud of haze hung about 20° above the lake (the observer being five miles distant,) and soon overspread the whole horizon. The morning of the following day was warm and misty, and by 12 m. it was clear and spring-like. Not a fruit germ was injured on the lake shore, but throughout the west and southwest the temperature steadily declined, without intermission during the day and night, down to 26°, and the day following was cold and blighting, and fruits were generally destroyed.

"The manner in which the lake exerts this influence is not uniform. Sometimes the warm emanations are condensed and may give off heat and obscure the atmosphere with haze, mist, or clouds, and no frost will appear. Under circumstances apparently similar, on the approach of a cold night, neither haze, mist, nor clouds of any kind form, but a stiff breeze springs up and the stars become uncommonly brilliant. The thermometer vacillates between 32° and 28°, rising with the gusts of wind and falling during the intervals of calm, and no frost is known. Again, none of these modifying causes may intervene, but the temperature may fall below the freezing point, ice may form on the surface of the water, and the expanded fruit leaves and blossoms be congealed. Under such circumstances the first rays of the rising sun on the following morning will be arrested by haze, which will soon thicken, and before noon a warm rain will probably fall, the frost will be abstracted gradually from the frozen vegetation, so that its

vitality will be unimpaired. Sometimes, however, the lake affords no protection. Thus in 1834 freezing weather continued through three days and fruits were cut off on the lake shore."

According to the more extended and detailed observations of George C. Huntington, esq., of Kelley's island, to whom we are indebted for much valuable data illustrative of the climate, history, and statistics of that region, the following temperatures characterize the lake waters near the islands at the periods designated:

A table exhibiting the temperature of Lake Erie surface waters near Kelley's island, at the periods named.

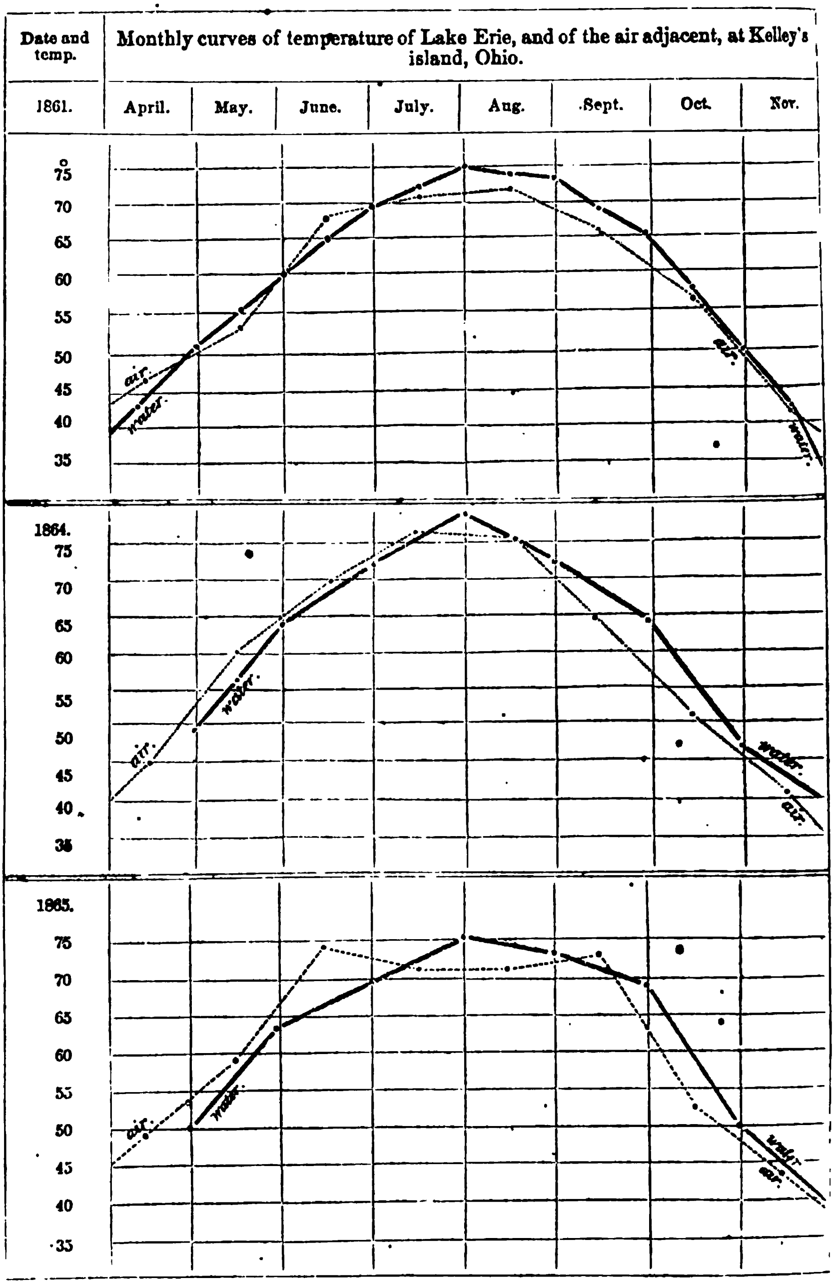
	March 31.	April 30.	May 31.	June 30.	July 31.	August 31.	September 30.	October 31.	November 30.	December 31.
	°	°	°	°	°	°	°	°	°	°
1859	?	41	55	67	73	70	63	47	39	?
1860	41	52	63	70	75	72	62	54	34	?
1861	36	51	60	70	75	73	65	50	37	34
1862	?	48	60	68	75	74	69	51	38	?
1863	?	47	62	70	74	72	64	49	40	?
1864	?	49	64	72	78	72	64	47	40	?
1865	?	50	64	?	75	73	69	50	39	?
1866	?	?	?	71	75	72	64	50	40	?
Means	38.5	48.3	61.1	59.4	75.0	72.2	65	49.7	38.3	34

By the above table a near approach to uniformity of temperature in the lake waters is observed to be maintained from year to year, seldom varying more than three degrees on either side of the mean of several years past. The close agreement of the temperature for the last of May with the mean temperature of the air of that month throughout the region will appear on comparing the above with the monthly means of the various stations already tabulated. This harmony continues throughout the season, and may be better illustrated by the diagram on the following page:

By the diagram of curves of temperature of the air and water in juxtaposition their accordance is clearly illustrated. This may perhaps require no further explanation than the general statement that as the curve of lake temperature indicated by the continuous line passing through the points laid down for the temperature observed on the last day of each month rises higher from time to time, so does that of the air, expressed by the broken line passing through the means for each month. If that of the lake descends, so does that of the air, a general parallelism being maintained with the water in advance until July or August. An exception appears in 1865, when the June air temperature was 5° to 7° above that of the water. At Kelley's island it appears that the water is generally warmer than the air through August to the end of November. In 1865, the finest of their autumn seasons, the air was 4° warmer through September, October, and November than the water on the last day of each of these months.

After August this great body begins to part with its warmth to the colder incumbent air, which it thus tempers, and this process continues during the winter. "While its progress is most rapid, strong southerly winds prevail at the surface, and volumes of clouds at high elevation may be seen at the same time moving rapidly in the opposite direction. Cool north winds begin to prevail about the middle of October, and the emanations from the lake to condense and pass off to the south in the shape of thick clouds, without discharging, at first, much rain. About the 20th of October the cold winds from the north seem to gain the ascendency. Squalls of rain, hail, and rounded snow appear alternately with intervals of clear warm weather. These squalls precede the autumnal frosts, and

gardeners feel no apprehensions for their tender vegetables until such premonitions have appeared."



While the temperature of the lake waters remains higher than during the nights of autumn on land near them, a fall of a few degrees brings in a current

of warm damp air from the lake, which restores the equilibrium and prevents the appearance of frosts as early as they occur further inland. At a distance of five or ten miles from the lake there usually occurs one or more "killing frosts" about the 25th to the 30th of September, but along the shore none occur until the last week in October, and on Kelley's island no frost injurious to vegetation appears until the 1st to the 25th of November, and often not until the 1st of December. This peculiar exemption from early autumn frosts permits the grape to mature perfectly, and this remark is often made by visitors to the vineyard islands, that they never before saw ripe Catawbas and Isabellas, these varieties being scarcely recognized as the same kind as those to which they have been accustomed. The long autumn also permits a lengthened harvest, extending over about two months. The first shipping of grapes as fruit beginning in the latter part of September, the gathering of Isabellas for wine is entered upon about the 15th of October, and the Catawba picking, ranging from the 1st of November to the 1st of December, closes the vintage.

THE ATMOSPHERIC MOISTURE OF KELLEY'S ISLAND.

I have been favored with results of daily observations made to determine the amount of invisible moisture in the atmosphere of Kelley's island for the last six months of 1866. These valuable notes are the only material of the kind by which to illustrate the peculiar climate of this station, and as far as they extend are satisfactory, and confirm previous surmises. They show conclusively the vast influence of water surroundings over the local climate, and are presented in conjunction with data obtained by the use of similar instruments at places remote from northern Ohio, all of which possess elements remarkably similar, but which, from the fact that some of them are inland, offer instructive contrasts as respects their proportions of atmospheric moisture, while another, situated on Delaware bay, though 1½ degrees further south than the Lake Erie station, appears to enjoy a very similar climate, at least for the months for which I have been favored with returns of meteorological observations.

In order more succinctly to present the facts, they have been arranged in tabular form, and comparisons instituted, the results of which are also tabulated. The accompanying "Table of condensed results," &c., will exhibit the numerical data, while the diagram of curves will present to the eye a graphic illustration of the leading facts of the table, and enable the reader more readily to grasp the ideas to be conveyed.

There are but three stations in southern New Jersey at which observations have been made with the psychrometer.

Notes of these observations for several months of 1866 have been submitted for examination, and the table of results has been compiled therefrom in conjunction with similar data from the lake station, in northern Ohio. The New Jersey stations are the following, viz:

Vineland, Cumberland county, in latitude 39° 30′ north, longitude 75° west, distant 20 miles from Delaware bay and about 25 miles from the ocean. Delaware bay, here from 10 to 15 miles wide, lies on the southwest, and is from 10 to 40 feet in depth, while over nearly two-thirds of the breadth it is less than 20 feet deep.

Haddonfield, Camden county, in latitude 39° 54′ north and longitude 75° west, 5 miles distant from the Delaware river, which is but one mile wide at, and for many miles below, its nearest point.

Greenwich, Cumberland county, about four miles from Delaware bay, within one mile of an extensive marsh, and beside a sluggish stream meandering through wide meadows. The bay is four miles wide on its southwest, and rapidly expands to several times this width a few miles below. Three miles of the breadth of the bay near Greenwich is perhaps of the average depth of but fifteen

feet, and the readiness with which its waters can be heated and evaporated is thereby increased.—(See Table on pp. 178 and 179.)

By inspecting each vertical column in succession the reader will perceive that in the first section of the "Table of condensed results," &c., I compare the temperature, &c., for 7 a. m., 2 p. m., and 9 p. m., and the monthly means for July and August, 1866, at each of the above-named stations. Glancing along the horizontal array of figures—those for Vineland for July, for instance—he will perceive, first, that the temperature of the air, or of the dry-bulb thermometer, was 74°.7 at 7 a. m.; that the march of temperature, or change to that of the 2 p. m. observations, was an addition of 15°.4, indicated by the sign plus, +, prefixed to the latter amount. The temperature at 2 p. m. was therefore 90°.1, but falling 16°.4 to 9 p. m., it stood at 73°.7, the decline being here expressed by the prefix minus accompanying the amount, thus, — 16°.4. The average or mean temperature derived from all the observations (93) was for July, 1866, at Vineland, 79°.50, as appears by the table.

Next the temperatures of the wet-bulb are exhibited in conjunction with the dryness or differences between them and the dry-bulb temperature at the same hours. Thus 72°.5 in the same horizontal line for Vineland for July, 1866, at 7 a. m., expresses the temperature of the wet-bulb, while 2°.2 implies that this stood as many degrees below the dry-bulb at the hour noted.

The calculated relative humidity, or the percentage of saturation, or the amount of moisture present in the air, compared with that which it could hold if saturated at the same temperature and under the same pressure, follow next in order in the table. The absolute humidity or number of grains troy which exist in a cubic foot of air, as calculated from the foregoing, and the dew-point, also obtained by calculation, are appended. By the latter term is implied the temperature to which it would be necessary to reduce a body in order that the condensation of the atmospheric moisture may commence thereon. Finally, the extremes of temperature, or the highest and lowest reached in the month, at Vineland at the hours of observation are added. These do not represent the *true* maxima and minima, which can be accurately obtained through the agency of self-registering thermometers.

In order to present a more precise and more striking exhibit I have arranged the same facts for several stations in pairs, and have placed the differences apparent on comparison in the line beneath. On comparing Haddonfield, New Jersey, with Kelley's island, Ohio, we find that though the 7 a. m. temperatures of the air differ but 1°.4, Haddonfield has risen by 2 p. m. to 4° above the Ohio station, and declined thence to agree more closely at 9 p. m. than at the morning hour. But when on comparing the wet-bulb temperatures, which vary with proportions of moisture present, we find that in the morning they are 5°.5 apart, at 2 p. m. 7°, and at 9 p. m. 4°.8, with a monthly mean of nearly 6° for each entire day. This expresses an extreme dryness, and its results were marked at our station by injurious effects on vegetation and especially by damage to the vine. This dryness is further strongly exhibited by comparison of the relative humidity at the places under consideration as displayed in the columns next in order. At 7 a. m. there appears to have been nearly 18 per cent. less at Haddonfield than at Kelley's island, at 2 p. m. about 37 per cent. less, and at 9 p. m. nearly 22 per cent. less, while for the entire month for each day there is exhibited 25°.4 per cent. less, a difference of no small moment to the losing side. For the dryness to be expressed by the dew-point the reader may compare them with the dry-bulb temperatures for their respective hours.

A comparison of the extremes recorded is worthy of attention. At Haddonfield the maximum in July, 1866, was 9° above the highest at Kelley's island, and the extreme cold for the same month 7° below that of the latter place—a range of perhaps 16° greater in New Jersey than on the borders of Lake Erie for the period under examination. In July, 1866, an extremely hot month

throughout the north, the differences between the dry and wet bulbs and relative humidity of Haddonfield and Kelley's island were remarkable, but in the cold month of August these differences were not so marked, for while the relative humidity of the Ohio station remained nearly unchanged, that of New Jersey was increased, as we would expect from the decline of power in the drying agencies so active in the earlier months, and Kelley's island is again shown to enjoy a climate more equable.

If we compare our data for Greenwich, New Jersey, with Kelley's island for July and August, 1866, the analogies come out in a striking manner; the elements of dry and wet bulb, absolute humidity, dew-point, and extremes of temperature, appearing to be almost identical. The relative humidity is, at the morning hour, in favor of Greenwich, but at noon and in the evening in advance at the Lake station, producing a near approach in the mean. These analogies would appear indeed extraordinary were we not satisfied that they are results from similar conjunctions of circumstances—their position as respects the warm shallow waters at their doors, the influence of which it is my purpose to elucidate. Here are two districts, one of which is but thirty feet above the level of the Delaware bay, the other nearly six hundred feet above the same, separated from each other by two degrees of latitude, and more than seven degrees of longitude, whose temperature for each day, the conditions of absolute humidity, and extremes of heat and cold, are almost identical, and which differ only in the distribution of their relative humidity throughout the day, to find an equalization of this element in their means for the months under consideration. The conclusion is inevitable that they are influenced by the peculiar circumstances that attend their location, and as these agree in their juxtaposition by wide and shallow waters, and in this alone, herein must be found an explanation of their peculiar climates. Moreover the fitness for the production of the tender fruits, such as the grape, and formerly of the peach, at the northern station, has been proved by extended experiences, and as respects the peach at the station in New Jersey. It may be that the greater dryness of the latter point at noon may not be found so favorable to the grape, which is, however, there grown by some for domestic use.

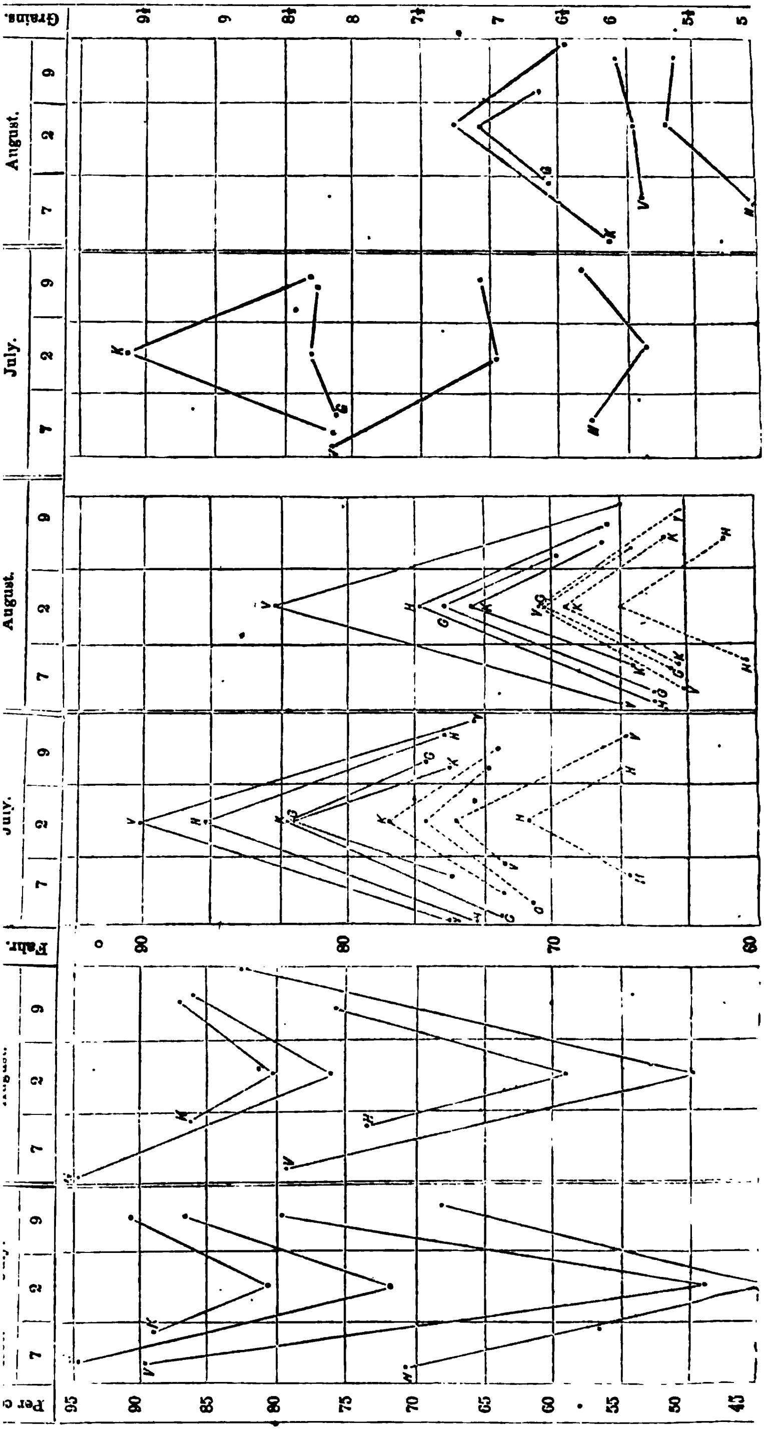
A comparison between Vineland and Greenwich will exhibit the much greater dryness of the former; for though the morning moisture may be favorable, that of mid-day is greatly deficient, being but little more than two-thirds of that of Greenwich, and one-half of that of Kelley's island, or twenty-four per cent. less than the former and thirty-two per cent. less than the latter, which may be assumed as the necessary amount for successful vine culture. The adaptation of much of the interior of New Jersey, remote from the bay and ocean, to the vine, has not been sufficiently well attested.

The diagram of curves needs but little explanation. The scale prefixed to the table of relative humidity is the percentage of saturation. The column headed 7, 2, and 9, indicate the hours of observation. Thus at 7 a. m., of July, 1866, the relative humidity at Greenwich, New Jersey, was about 95 per cent.; at 2 p. m. it sunk to 72, to rise at 9 p. m. to near 87 per cent. The curves, so called, with which the letters, K. for Kelley's island, V. for Vineland, and H. for Haddonfield, are associated, are each delineated on the same principle. The table of temperature of dry and wet bulbs may be readily understood. It will be seen that the continuous lines represent the temperature of the dry-bulb or of the air, and the broken lines that of the wet-bulb, and that those for Kelley's island approach much nearer to each other; next in proximity are those for Greenwich; those for Vineland follow; and lastly, that the lines of dry and wet bulb temperature for Haddonfield, the dryest station, are most distant from each other.

When made.	Names of stations.	Temperature of air and march of temperature. 7 A. M. Temp.	7 A. M. March.	2 P. M. Temp.	2 P. M. March.	9 P. M. Temp.	Means for the month.	Temperature of wet bulb, and difference between wet and dry. 7 A. M. Temp.	7 A. M. Dryn's.	2 P. M. Temp.	2 P. M. Dryn's.	9 P. M. Temp.	9 P. M. Dryn's.	Means for the month.	Differ'ce of mean of wet and dry bulbs.
		°	°	°	°	°	°	°	°	°	°	°	°	°	°
1866. July	Vineland, N. J	74.7	+15.4	90.1	−16.4	73.7	79.50	72.5	−2.2	75.2	−14.9	67.3	−6.4	71.60	−7.90
	Haddonfield, N. J	73.5	+13.8	87.3	−12.3	75.0	78.62	67.0	−6.5	71.5	−15.8	67.7	−7.3	68.73	−9.89
	Greenwich, N. J	72.5	+10.5	83.0	− 6.9	76.1	77.19	71.3	−1.2	76.1	− 6.9	73.2	−3.9	73.53	−3.66
	Kelley's island, Ohio	74.9	+ 8.3	83.9	− 8.7	74.5	77.57	72.5	−2.4	78.5	− 4.7	72.5	−2.0	74.53	−3.04
August	Vineland, N. J	67.3	+16.1	83.4	−16.4	67.0	72.61	63.3	−4.0	70.2	−13.2	63.8	−3.2	65.81	−6.80
	Haddonfield, N. J	65.0	+11.9	76.9	− 9.2	67.7	69.87	60.9	−4.1	67.2	− 9.7	62.9	−4.8	63.67	−6.20
	Greenwich, N. J	65.3	+10.2	75.5	− 6.6	68.9	69.91	64.3	−1.0	70.1	− 5.4	66.4	−2.5	66.94	−2.96
	Kelley's island, Ohio	65.8	+ 8.8	73.8	− 6.4	67.4	69.03	63.5	−2.3	69.8	− 4.0	65.0	−2.4	66.12	−2.91
July	Haddonfield, N. J	73.5	+13.8	87.3	−12.3	75.0	78.62	67.0	−6.5	71.5	−15.8	67.7	−7.3	68.73	−9.89
	Kelley's island, Ohio	74.9	+ 8.3	83.2	− 8.7	74.5	77.57	72.5	−2.4	78.5	− 4.7	72.5	−2.0	74.53	−3.04
	Differences	+ 1.4	....	− 4.1	....	− 0.5	− 1.05	+ 5.5	....	+ 7.0	....	+ 4.8	....	+ 5.80	....
August	Haddonfield, N. J	65.0	+11.9	76.9	+ 3.2	67.7	69.87	60.9	−4.1	67.2	− 9.7	62.9	−4.8	63.67	−6.20
	Kelley's island, Ohio	65.8	+ 8.0	73.8	+ 6.4	67.4	69.03	63.5	−2.3	69.8	− 4.0	65.0	−2.4	66.12	−2.91
	Differences	+ 0.8	....	− 3.1	....	− 0.3	− 0.84	+ 2.6	....	+ 2.6	....	+ 2.1	....	+ 2.45	....
July	Greenwich, N. J	72.5	+10.5	83.0	− 6.9	76.1	77.19	71.3	−1.2	76.1	− 6.9	73.2	−3.9	73.53	−3.66
	Kelley's island, Ohio	74.9	+ 8.3	83.2	− 8.7	74.5	77.57	72.5	−2.4	78.5	− 4.7	72.5	−2.0	74.53	−3.04
	Differences	+ 2.4	....	+ 0.2	....	− 1.6	+ 0.38	+ 1.2	....	+ 2.4	....	− 0.7	....	+ 1.00	....
August	Greenwich, N. J	65.3	+10.2	75.5	− 6.6	68.9	69.91	64.3	−1.0	70.1	− 5.4	66.4	−2.5	66.94	−2.96
	Kelley's island, Ohio	65.8	+ 8.8	73.8	− 6.4	67.4	69.03	63.5	−2.3	69.8	− 4.0	65.0	−2.4	66.12	−2.91
	Differences	+ 0.5	....	− 1.7	....	− 1.5	− 0.88	− 0.8	....	− 0.3	....	− 1.4	....	− .82	....
July	Vineland, N. J	74.7	+15.4	90.1	−16.4	73.7	79.50	72.5	−2.2	75.2	−14.9	67.3	−6.4	71.60	−7.90
	Greenwich, N. J	72.5	+10.5	83.0	− 6.9	76.1	77.19	71.3	−1.2	76.1	− 6.9	73.2	−3.9	73.53	−3.66
	Differences	− 2.2	....	− 7.1	....	+ 2.4	− 2.31	− 1.2	....	+ 0.9	....	+ 5.9	....	+ 1.93	....

Table of condensed results of meteorological observations made at sundry stations in West New Jersey, and at Kelley's island, Ohio, &c.—Continued.

When made.	Names of stations.	Relative humidity or percentage of saturation. 7 A. M.	2 P. M.	9 P. M.	Means for the month.	Grains of vapor in a cubic foot of air. 7 A. M.	2 P. M.	9 P. M.	Means for the month.	Dew point obtained by calculation. 7 A. M.	2 P. M.	9 P. M.	Highest temperature.	Lowest temperature.	True minimum.
1866.		°	°	°	°	°	°	°	°	°	°	°	°	°	°
July	Vineland, N. J.	89.8	48.3	79.5	72.5	8.20	6.96	7.08	7.41	71	65.5	62.6	101¼	60	?
	Haddonfield, N. J	70.8	43.9	68.6	61.1	6.23	5.84	6.33	6.13	64.2	61.2	62.5	102	61¼	56¼
	Greenwich, N. J	94.4	71.9	86.7	84.3	8.10	8.22	8.25	8.19	70.7	71.5	69.4	94	62	?
	Kelley's island, Ohio	88.6	80.8	90.2	86.5	8.19	9.59	8.25	8.63	71.0	75.1	71.0	93	64	?
August	Vineland, N. J.	79.2	50.0	83.5	70.9	5.84	5.94	6.09	5.95	60.0	61.3	61.6	91	52	?
	Haddonfield, N. J	73.3	58.8	75.9	69.3	5.01	5.73	5.67	5.47	57.5	60.5	59.1	88	55	50
	Greenwich, N. J	94.5	75.8	86.8	85.7	6.55	7.08	6.67	6.77	63.2	66.2	64.5	83	55	?
	Kelley's island, Ohio	87.1	80.1	87.4	84.9	6.16	7.24	6.43	6.61	61.6	66.8	63.1	85	55	?
July	Haddonfield, N. J.	70.8	43.9	68.6	61.1	6.23	5.84	6.33	6.13	64.2	61.2	62.5	102	61¼	....
	Kelley's island, Ohio	88.6	80.8	90.2	86.5	8.19	9.59	8.25	8.63	71.0	75.1	71.0	93	64	....
	Differences	+17.8	+36.9	+21.6	+25.4	+ 1.96	+3.61	+1.92	+ 2.50	+ 6.8	+13.9	+ 8.5	− 9	+ 2¾	....
August	Haddonfield, N. J.	73.3	58.8	75.9	69.3	5.01	5.73	5.67	5.47	57.5	60.4	59.1	88	55	....
	Kelley's island, Ohio	87.1	80.9	87.4	85.1	6.16	7.24	6.43	6.61	61.6	66.8	63.1	85	55	....
	Differences	+13.8	+22.1	+11.5	+15.8	+1.15	+1.52	+0.76	+1.14	+ 4.1	+ 6.4	+ 4.0	− 3	± 0	....
July	Greenwich, N. J	94.4	71.9	86.7	84.3	8.10	8.22	8.25	8.19	70.7	71.5	69.4	94	62	....
	Kelley's island, Ohio	88.6	80.8	90.2	86.5	8.19	9.59	8.25	8.63	71.0	75.1	71.0	93	64	....
	Differences	− 5.8	+ 8.9	+ 3.5	+ 2.2	+0.09	+1.37	±.00	+0.44	+ 0.3	+ 4.4	+ 1.6	− 1	+ 2	....
August	Greenwich, N. J	94.5	75.8	86.8	85.7	6.55	7.08	6.67	6.77	63.2	66.2	64.5	83	55	....
	Kelley's island, Ohio	87.1	80.1	87.4	84.9	6.16	7.24	6.43	6.61	61.6	66.8	63.1	85	55	....
	Differences	− 7.4	+ 4.3	+ 0.6	− 0.8	−0.39	+0.16	−0.24	−0.16	− 1.6	+ 0.6	− 1.4	+ 2	± 0	....
July	Vineland, N. J.	89.8	48.3	79.5	72.5	8.20	6.96	7.08	7.41	71.0	65.5	62.6	101¼	60	....
	Greenwich, N. J	94.4	71.9	86.7	84.3	8.10	8.22	8.25	8.19	70.7	71.5	69.4	94	62	....
	Differences	+ 4.6	+23.6	+ 7.2	+ 11.8	−0.10	+1.26	+1.17	+0.78	− 0.3	+ 6.0	+ 6.8	− 7¼	+ 2	....


Grains.
August.
July.
Fahr.
Per c

The "curves" of absolute humidity, or the number of grains of vapor in a cubic foot of air, are more impressive. Here the indications of moisture at Kelley's island, Vineland, and Greenwich are nearly the same for 7 a. m., of July, 1866; but while at the latter station they remain nearly the same because near to a constant source of vapor—the shallow waters of the bay—Vineland, in the hot interior, exposed to intense drying agencies, declines during the forenoon, and later, perhaps, to regain but little by the time of evening observation. It is evident, however, that Vineland receives a supply of vapor during the night to restore the evening measure to that noted at the morning hour. This may be derived from a moderate sea-breeze, sometimes scarcely perceptible. Kelley's island, it will be seen, gains a large addition by 2 p. m., because surrounded by warm shallow waters exposed to every wind that blows; but returns by 9 p. m. to the morning measure, the excess raised by the mid-day heats having been probably wafted inland by the lake breeze which prevails near the shores in the warmth of summer. Haddonfield exhibits a lower degree of absolute moisture at 7 a. m. than the other stations; still less at 2 p. m., and returns in the evening to its morning's measure. As the temperature of August was much reduced, the absolute moisture sustained was, of course, less at all the places under consideration, as the diagram will prove.

If the reader will compare the "Table of condensed results," &c., with the "Diagram of curves," each will be found to aid the other in giving him a more distinct comprehension of the lessons intended to be conveyed.

KELLEY'S ISLAND IN NOVEMBER, 1865.

For most of the historical portion of the following we are indebted to a notice of the island by George C. Huntington, published in the "Fire Lands Pioneer," and for the statistics to J. A. Harris, of the "Cleveland Leader." Kelley's island, unnoticed in our Gazetteers and misnamed Cunningham's island on many maps, lies but four miles from the southern shore of Lake Erie, distant about twelve miles from Sandusky and sixty miles from Cleveland, Toledo, and Detroit. In form it is irregular, but is about two and a half miles long and about two miles wide, containing nearly 2,800 acres of strong tenacious limestone clays, one-half of which is suitable for cultivation, and numbers a population of nearly eight hundred people.

A few miles west of Kelley's island lies a group of islands, among which is "Put-in bay," all more or less adapted to vine-growing. "Put-in bay," the "South Bass" of the maps, contains about 1,000 acres, and abounds in vineyards. Here every dwelling is surrounded by vines, and they extend away to the bays and gravelly beach, or to the bold edge of the rocky shores.

The peninsula northwest of Sandusky, and extending into the lake about fifteen miles, consists of excellent land, and those parts lying directly on the water side are well adapted to grape culture, and extensively planted with vineyards.

In 1843, it is said there were but two Isabellas and one Catawba vine upon Kelley's island, and that Charles Carpenter, who settled there in that year, having observed that they flourished, planted six vines, and afterwards half an acre. In 1846 the value of the grape crop of the island, which now amounts to hundreds of thousands, did not exceed the sum of five dollars. These were grown by D. Kelley, the only individual whose vines were in bearing condition. In 1852 the vines planted by Charles Carpenter bore fruit, and his neighbors, ceasing to ridicule, began also to plant vines. Nine years after, in 1861, the value of the grape crop was returned by the township assessor at $51,080, the product of 128½ acres. About one-half of the vines were then producing their first crop.

In 1862 about 494 acres had been planted, and in 1865 there were 700 acres in bearing condition, and 100 acres more were planted in that year.

The average yield of the last year, 1865, was estimated at three and a half tons per acre, and an aggregate product of 2,400 tons of grapes, of the total value of $360,000.

The first shipment of grapes was made on the 18th of August, when Hartford Prolifics were sold for twenty-five cents per pound. The average prices received for packing-grapes was twelve and a half cents, and for wine-grapes as low as five cents.

Land as productive as that of Kelley's island and the vicinity has steadily advanced in value until from $50 in 1854, it has reached $700 per acre in 1865. Bearing vineyards are now held at $1,500 an acre, and judging from past crops and the prices received therefor, will prove ten per cent. investments at $2,000 per acre, and in 1865 were fully a twenty per cent. stock.

In 1854 Addison Kelley sold the first land for vineyard purposes, a tract of five acres, for $50 dollars per acre. He limited his purchaser to five acres, and soon sold another lot at $60, then at $75, and finally the price advanced to $400 per acre. George C. Huntington also disposed of some of his grape land in small lots at similar prices.

For nineteen years no check has occurred to mar the fair promise of the early vintages. The first vines planted have regularly yielded full crops, and that for the past year, 1865, was as large as any previous one, and its product much more valuable. At present upwards of 5,000 acres upon the shores of Lake Erie and the adjacent islands are devoted to the culture of the grape, 3,500 acres of which, it is said, produced, in 1865, about 5,000 pounds per acre.

That the locality is eminently favorable to the continued health of the vine is shown by the fact that the Catawbas planted in 1844 are now in as good bearing condition as any of the younger vines, less than half an acre having produced in 1865 upwards of 2,700 pounds of fruit fitted for table use, and has never failed for twenty years in quality or quantity of its fruit.

Addison Kelley was among the first of the island grape-growers, and has planted about thirty acres, nineteen of which are in bearing and yielded in 1865 seventy-two tons of grapes, worth $160 per ton. His manufacture of wine would reach 10,000 gallons, a ton of grapes yielding 200 gallons of juice, or 175 gallons of wine.

Charles Kelley has a beautiful Catawba vineyard of nine acres, and one of Isabella in full bearing. His harvest in 1865 was 28 tons of fruit, all of which was sold as grapes. Eight tons of Catawbas were sold at 14 cents per pound, and eight tons were purchased by Cincinnati vintners at 8 cents, and 4½ tons at 11½ cents, for preservation, in a Chicago fruit-house.

George C. Huntington early paid much attention to grapes, and encouraged the enterprise by disposing of portions of his farm for vineyards. He has seven acres in bearing. He manufactured 2,350 gallons of Isabella, and 350 of Catawba wine, in 1865, and sold eight tons of Catawbas in Cleveland for wine making. With this grape-grower Isabella wine is a specialty, and his vaults are stored with specimens of the successful vintages for nine years past. His Isabella wines have attained a wide reputation.

Charles Carpenter was also a pioneer grape-grower and wine-maker on Kelley's island. One of his principal wine vaults, arched in the solid rock of the extensively worked quarry on his premises, is 37 feet wide, 120 feet long, and 16 feet high. His two vaults now contain about 25,000 gallons, the product of previous vintages, and his crop of 1865 amounted to 18,000 gallons more.

Of the product of the island about half was sold abroad for conversion into wine. One Cleveland vintner purchased 150 tons of island fruit, and another 100 tons more. The other half of the island fruit was packed and sold for table use, or made into wine here. There are twelve large presses on the island, and

a number of smaller ones, most of which are in operation day and night during the vintage season. About 100,000 gallons of wine were made and stored on Kelley's island in 1865, and this amount would have been greatly increased with suitable storage facilities.

The apples of Kelley's island should not be overlooked, as they are a certain crop and of superior quality. In 1865 they sold on the landing at $5 per barrel. The sale of grape roots and cuttings is also not a small item of business, sixteen millions of cuttings having been made on the island in 1864, worth from $2 to $3 per thousand.

The cost of preparing and planting a vineyard on the island is about as follows: Under-draining, $100 per acre; ploughing, $30; posts, $20; half ton of annealed wire, $100; 1,000 roots, $25; planting, $100; cultivation the first year, $20. During the first two years the cost of cultivation is about the same as for corn, and crops of potatoes are usually grown between the rows of vines. To attend and harvest an acre of vineyard costs about $100, a good laborer attending about six acres.

The gathering of grapes is mainly done by women and children, who, with scissors, clip off the clusters and free them from unripe or defective berries. The vineyards are usually subjected to three pickings, the first and second of choice table fruit, and the third for wine making. For the latter purpose the longer the bunches hang on the vine without being affected by very heavy frosts, the sweeter the fruit becomes and the richer the juice.

The vines are usually planted at six by eight feet, though some more recent vineyards are set out at eight by eight, or at eight by nine feet apart; but all are trained on wire trellis—the best and cheapest mode, the wire longest in use showing no signs of rust or failure.

THE FRUIT DISTRICT ADJACENT TO LAKE MICHIGAN.

The influence of the lake waters by which the State of Michigan is surrounded is very striking throughout the whole extent of the lower peninsula. Peaches are occasionally grown in the central counties, while in the same latitude west of lake Michigan this fruit is seldom, perhaps never, brought to perfection without artificial help. This influence is also shown by the almost unfailing crops of apples in Michigan, which, in this respect, is excelled by no other State in the Union. Illinois, Wisconsin, and Iowa, in the same latitude, or even further south, are found quite unsuited to the growth of the more tender sorts; and the most hardy are liable to fail except in sheltered or favored localities. In Michigan the peach belt proper is but a narrow strip of a few miles in breadth, varying somewhat from local influences—chiefly the position, protection by timber, the presence of water courses, &c.; the amount of product appearing to decrease in the ratio of distance from the lake when other conditions remain the same. At ten or twelve miles from the lake the crop of peaches sometimes fails, while at places but one or two miles therefrom it is uninjured. Other observers report that the protecting effects of the lake are very marked for four or five miles distant and become obscure at eight or ten miles therefrom.

Peach growing seems to occupy the attention of the people on the lake shore, especially in the St. Joseph's district. Every old settler, and every "new comer," plants peach trees by hundreds and thousands. Previous to the unprecedented destruction of the peach buds by the cold January of 1864, a heavy crop was considered certain in alternate years in this region. In 1864 no crop of peaches was produced, though a very fine yield of grapes was gathered.

The best locations for vineyards are on the highest lands within one or two miles of the lake. Throughout this favored border district the dews are so light as to be scarcely noticed, and the grapes have not suffered from rot, in these respects agreeing with the climate of the southern shore of Lake Erie, and indicating the absence of extreme low temperature by night, during the growing

season. The soil is porous, composed of sand and gravel intermixed with loam. Near the shore it is quite sandy, and though it may be esteemed poor, seems to be well adapted to the peach.

From the following, extracted from a communication by Henry S. Clubb, secretary of the Grand Haven Horticultural Association, and published in the monthly report of the Agricultural Department for November and December, 1866, the reader may obtain a clearer view of the physical peculiarity of this shore region:

"The general character of the eastern shore of Lake Michigan, from six to ten miles east of the lake, is sandy, and close thereto the white sand is whirled into fantastic shapes by the wind, in some instances forming hills almost as white as snow, and from two hundred to four hundred feet above the level of the lake. These hills are partially covered by forest trees, consisting of pine, hemlock, beech, maple, oak, a small growth of cedar, and a native vine of small value.

"Inland from the sand hills are numerous small lakes or bayous, from one to six miles in extent, around which are sloping banks of sand with an occasional substratum of white marl. Some of the valleys contain a swamp and black soil, and such spots are highly prized, being the only portions adapted to gardening or meadows. Around these small lakes, on the sloping banks, and on the tablelands of only moderate elevation, the peach and the grape appear to have found their natural position, and lands which a few years ago would not sell at five dollars per acre, now command from ten to fifty dollars, and in close proximity to shipping ports much higher rates.

"Corn is seldom grown here in large quantities, and neither wheat nor grass can be obtained, except on the spots above mentioned. Rye and buckwheat are more successfully cultivated.

"The valley of the St. Joseph's river, in southwestern Michigan and northern Indiana, continues to attract attention as one of the best fruit-growing regions of the West. The portion of the valley which lies within eight or ten miles of the lake offers better advantages than that further inland, but the entire valley affords a soil and climate remarkable for adaptation to fruits of nearly all the varieties grown in temperate latitudes. In seasons when the peach crop is destroyed in other regions, both north and south, the St. Joseph's country is expected to furnish a crop of scarcely diminished excellence and abundance, and the expectation is usually realized. The pear, grape, cherry, apple, blackberry, raspberry and strawberry are here equally successful, and the attention given to these fruits is on the increase. A writer in the Prairie Farmer, for November 27, 1865, states that sales of fruit lands in the vicinity of Benton harbor, from the first of April, had amounted to the large aggregate of $200,000, and that sales were made almost daily at prices ranging from $100 to $800 per acre. The aggregate product of this fruit district is growing in importance, the gross proceeds having been estimated by the most intelligent growers at about $200,000 for fruit of all kinds sold during the season of 1865.

In Cass county, north of St. Joseph's, grapes have succeeded thus far, though the experience of growers has been limited to few varieties. The Delaware, Concord, Maxatawny, Diana, Allen's Hybrid, and Rogers's Hybrid have all, on the grounds of an experienced horticulturist, proved perfectly successful, and his crop, in 1865, though not heavy, because judiciously thinned, was the admiration of all who saw it. Grapes and apples succeed much better on the stronger lands, a few miles from the lake. The grapes here require winter protection. The fruit crop of Cass county was estimated, in 1865, to be equal to the wheat crop of the same year.

The region around Grand Haven, in Ottawa county, latitude 43° north, appears to be equally well adapted to the grape and the peach. A vineyard of about three-fourths of an acre on the south shore of Spring lake, north of Grand Haven, belonging to Savidge & Cutler, produced, in 1865, about $800 worth

of grapes. The yield in 1866 was about the same in quantity; but owing to the fears or prevalence of cholera at Chicago, the revenue obtained was smaller. This vineyard was planted on a decided slope towards the north, and has a blind fence on the west.

There are numerous vineyards in different stages of progress in this district, and considerable tracts are clearing for vineyards elsewhere on the eastern shore of Lake Michigan, which will probably rival the southern borders of Erie. While the heavy forests of pine timber remain undisturbed, this region will continue to possess superior advantages for fruit growing, beside those derived from the influences of the deep, unfrozen waters of Michigan.

The shores of the small inland lake above referred to are a favorite field for grape and peach planting. The peach orchard of Mr. Lovell is reported a model of its kind. It contains about thirty acres, and for the crop of 1866 $25,000 was offered and refused. Ten years ago this orchard was covered with a scrubby growth of oak, and did not appear worth clearing. But little manure has been applied; the trees have been carefully trimmed and freed from worms, and the soil loosened by cultivation. Here early and late Crawfords and Stump-the-World are produced, equalling the finest productions of Delaware and New Jersey. The prices realized for grapes in 1866 were from from 12½ cents to 25 cents per pound, and for peaches from 50 cents to $3 per crate of about half a bushel.

The climate and soil of Michigan are admirably adapted to the production of fruit of the best quality. Though the apple crop of Michigan for 1865 was but a moderate one, an unusually large amount was exported, because the scarcity in the east rendered the business of shipping remunerative. The importance of the apple trade of Michigan is illustrated by the returns of the number of barrels shipped prior to November 10, 1865, at the different stations on the Michigan Central and other roads, as reported in the Chicago Tribune of that date. These amounts varied from 150 to 15,000 barrels, seven stations having received 5,000 and upwards; four, 10,000 and upwards; the aggregate amount rising to 134,000 barrels, shipped at twenty-seven stations, and much more to come forward, which probably swelled the total to 150,000 barrels. The Michigan Southern railroad, which passes through an old and good fruit-producing country, would probably exhibit a return of 100,000 barrels, and the line of the Detroit and Milwaukee railroad in the north, upwards of 75,000 barrels. From the Grand Trunk, St. Clair river, and local districts around Detroit, the shipments by the St. Joseph and Kalamazoo rivers, and at other points on Lake Michigan, are estimated to have reached 91,000 barrels. This trade was compressed into a period of six weeks, the avenues of traffic were almost blocked up, with immense quantities of apples coming forward for shipment, while warehouses were piled to overflowing, and temporary sheds were erected for storing the fruit until it could be removed to its destination. A total aggregate of 410,000 barrels of apples thus appears to have been shipped prior to the 10th of November, almost all of them the product of Michigan, realizing the round sum of $1,435,000 to the State.

In 1839 the total value of her orchard products, according to the census of 1840, was but $16,075; for 1849, $132,650; in 1850, $1,137,678; and in 1865 it could not have fallen short of $2,000,000!

According to the testimony of one of the best pomologists of Michigan, most of the popular varieties of New York and New England fruits are equally successful in eastern Michigan; but this success is restricted to comparatively narrow limits, and ignorance of this fact results in frequent unprofitableness of many orchards. The eastern, northern, and most western portions of the State, which may be styled the timbered regions, are better adapted to the ordinary varieties of apples and pears which may be found sufficiently hardy to endure the climate. In the southwestern portions of the State, not adjacent to the lake, which assimilate in character to the adjoining States of Indiana and Illinois, and may be

termed the "prairie region," only the more hardy varieties can be relied on. The climate of the region between these two sections is of an intermediate character. It cannot be overlooked that the success or failure of varieties is owing to difference in the soils, as well as climates, of the various sections. The valuable influences of the waters of Lake Michigan are well illustrated by accounts of the climate of the Grand Traverse region, published in the Transactions of the Michigan Agricultural Society for 1854, and in the Grand Traverse Herald of March 4, 1864.

It has been demonstrated by the researches of I. A. Latham, of Milwaukee, that the temperature during the winter is much milder at points on the western shore of Lake Michigan than at others a few miles west, and that this rapidly declines as we proceed towards the Mississippi river, so that the mean temperature of January known at Milwaukee is the same as that known in Whitesides county, Illinois; that of Sheboygan, on Lake Michigan, the same as that of Galena; that of Green Bay, as that known at Prairie du Chien, though differing in latitude 80, 90, and 120 miles respectively. It has also been shown by Dr. Latham, in his map of Wisconsin, on which are depicted the lines of mean January and July temperatures extending across the State, that while Lake Michigan elevates the mean for January, it depresses that for July, rendering the lake climate more equable. Thus, places in the southeastern corner of the State, which may enjoy a July mean temperature of 71°, have their parallels in this respect on a line extending due northwest across the State to the Mississippi at St. Croix falls, nearly half a degree of latitude north of St. Paul, and in Minnesota, beyond St. Paul, the line of mean temperature tends towards the northwest. At the Falls of St. Croix this line is 200 miles further north than at Racine, on Lake Michigan. All other locations on or near the western border of the lake have a proportionally lower temperature in summer than places in the interior in the same latitude and on the western border and in the States beyond. An inspection of this instructive map would more forcibly illustrate the extraordinary deflection of the summer and winter isotherms, and the immense climatic value of the bordering waters, than could pages of text without its aid. Lines of equal January mean temperatures extend across the State from northeast to the southwest, while lines of equal July temperatures range from the southeastern to the northwestern border, each obviously deflected widely from its normal conformity to the parallels of latitude by a great disturbing agency.

If we trace these lines of equal mean January or July temperatures across the lower peninsula of Michigan, we shall find the same agency at work bending them into curves, as we recede from the lake towards the interior, and approach Huron on the east. Sufficiently abundant data have not yet been collected to enable us to lay down these lines with the precision desirable; enough, however, is determined to show that both the western and eastern borders are largely influenced by the bounding lakes, and both isolated observations at distant points and the results of the agriculture of the district plainly demonstrate the truth of the presumption. Thus the line of equal mean temperature for January may be traced from the Mississippi, at Rock island, Illinois, northeast, through Kenosha, Wisconsin; thence across the lake, north of Grand Rapids, Michigan, to a point on Lake Huron not far south of Saginaw bay. Another line, passing through places having the same January mean, would take its course through Peoria, Ottawa, Aurora, in Illinois, and New Buffalo, Battle Creek, Lansing, and Detroit, in Michigan; thus giving to interior Michigan the January temperature of districts in Illinois 150 miles further south.

The favoring influences of the lakes are equally well attested by the results which attend fruit-growing in the State of Michigan, as compared with the indifferent results in Wisconsin and northern Illinois.

An observant correspondent remarks that in Berrien county, Michigan, six miles from the lake, the temperature in winter is about ten to twenty degrees

higher than at many places eastward and southward of this point. An observer, resident for more than thirty years at Grand Haven, and whose journal extends over that period, has found the temperature at his station ten and twenty degrees higher during "cold spells" than at Milwaukee, immediately opposite, in Wisconsin. The buds of the peach are thus generally preserved from destruction, which often awaits them at a distance from the lake; their blossoming is also retarded immediately along the shore by as much as five to eight or ten days beyond that in the interior. This latter result is due to the action of the waters upon warm southwestern winds, which are cooled in their transit over the lake, through the action of the simple law by which bodies differing in temperature tend to attain an equilibrium, as well as to the absorption of heat by the vapors arising from the lake, a large amount of heat-force being required to raise the waters into vapor. The conservative action of these waters is thus plainly apparent; they warm the air around them in autumn and winter, as well as temper the heat from distant sources, borne by the treacherous southwest winds in spring. The latter action is clear from the fact that places too far south in Michigan to experience the tempering agency of the water upon the warm winds, frequently suffer from a premature expansion of their fruit buds, and consequent destruction of the peach crop from after cold. Southeast of a line drawn from the head of Lake Michigan, due northeast, the peach buds are much more liable to injury from too early blossoming than at places northwest of this line.

In Berrien county, the most southwestern in Michigan, extending from the lake a distance of twenty-five miles, on the southern boundary of the State, but narrowing on the north, it is said, all the peach buds for 1864 were destroyed, except in the district immediately bordering the lake; here the temperature was but 7° below zero on the 1st of January, 1864, while two miles back it sank to 12° below.

A correspondent writing from southern Illinois says: "The great cold wave that rolled down from the Arctic regions on the first day of the year 1864 has crushed in its pathway every blossom of the peach, the apricot, and the nectarine from the northern limits southward beyond the State of Tennessee, and perhaps further south. Never within the history of the West has there been such widespread disaster, never such a far-extended wave of Arctic cold. Peach trees, valued at $25,000, were destroyed hereabouts in orchards, and the entire nursery stock was also rendered valueless." On that day, when the temperature exceeded anything ever before known in extremes of cold throughout Minnesota, where the mercury descended to 38° below zero, but 2° above its freezing point, and at Milwaukee to 30° below zero; and in Illinois, farther south, from 20° to 28° below; at Holland, in Ottowa county, near Grand Haven, Michigan, nearly opposite, on the eastern shore of the lake and in the same latitude as Milwaukee, Wisconsin, the mercury sank to 8° below zero only—a very tolerable temperature comparatively—that the same wave of cold rolled over Michigan is evident from the fact that at Lansing, in the centre of the State, a temperature of 22° below zero was experienced on the same day.

This wide-spread and destructive cold killed the peach-buds at St. Joseph's, on the lake, but the trees were not injured. Many of these trees have been planted fifteen to twenty years and yet survive, while in Branch county, in the interior, on the southern line of Michigan, adjoining the northeast corner of Indiana, the peach trees have been killed on five occasions during twenty years past, and the fruit buds destroyed almost every two years. At South Haven, twenty-four miles, and at Grand Haven, sixty-five miles further north than St. Joseph, and therefore more distant from the head of the lake, but on its shore at its widest part, and near deeper waters, the peach-buds were not killed in January, 1864. At Grand Haven the peach trees have borne fruit for nine years in succession, and the tender twigs were uninjured by the winter of 1865–'66.

Between St. Joseph and White Haven, at Hartford, Van Buren county,

twelve miles from the lake, the trees were uninjured, though the buds were killed in 1864; while in the adjoining township of Lawrence, seventeen miles from the lake, a part of the trees were killed, and at Paw-Paw, adjoining Lawrence, on the east, and twenty miles from the water, the peach trees were all destroyed.

The extreme temperatures of January, 1864, associated with the places in Michigan where entire or partial destruction of buds and trees occurred, were as follows: In Branch county, near the middle southern line, ninety miles east of the lake, 20° was observed; at St. Joseph, 8°; at White River, ninety miles north of the latter place, and on the lake shore, 7°; and at Benzonia, one hundred and eighty miles north of St. Joseph, latitude 44½, and ten miles inland, 11°. On the same day, the temperature at Chicago, Milwaukee, and Green Bay, to the western shore opposite to the above respectively, had been in the same order as low as 28°, 27°, and 26°.

Thus, the great unbroken sheet of cold air, extending from eastern Europe to the Sandwich islands, flowing southward and almost everywhere reducing the temperature below its normal height, was greatly modified in its intensity by the waters of the noble lake which lay like a guardian at the portals of the State of Michigan.

CONCLUSION.

The foregoing attempt to supply more definite information respecting the local districts where fruit-growing may be esteemed generally successful, will not retrieve the loss of the tens of thousands of dollars spent in ineffectual efforts to establish vineyards in many inland sections which must ever remain unfitted therefor. It may, however, if used aright, arrest the reckless squandering of money in similar ill-judged schemes. For thirty years all attempts to grow the Isabella and Catawba in the open country in Pennsylvania have entailed loss upon the enthusiastic planters. It is only in the large cities on or near Lake Erie, or on a few choice sites, that they have proved remunerative. An intermediate year or a few years may occur when a good crop is gathered and hopes are again cheered, to be followed by several seasons in which mildew and rot destroy the leaves and fruit, and finally the vine itself. That the new varieties will prove in the end more successful than the abandoned Catawbas and Isabellas, in our middle regions, we greatly fear will not be the experience of many thousands who have planted them. In more northern regions, or more favored localities, they may be found to be valuable substitutes.

By the few choice sites above referred to we have reference to certain localities at varying heights above the bottoms of valleys in the middle or more southern States, though distant from water privileges, where the vine may be grown with success. These zones of more tempered extremes may vary in height of range above different valleys, according to the physical construction of the country. Many valleys are in summer nights filled with the cold dry air from the mountain sides, while the moist, warmer, and buoyant air of the valley bottom is raised to the hillside, to shield the plants at a definite height from the effects of frost. The more successful zone of mountain side is, of course, above the frost line, which may often be traced at heights varying with the latitude and elevation of the valley. This line of frost in the southern valleys of the Alleghanies may be seen about 300 or 400 feet above the bottom, bounded by a horizontal line of verdure, resembling a vast ribbon above the black ground of the injured vegetation below. In the more northern valleys of the Alleghanies this is not so apparent, because vegetation does not differ so widely at different heights. Peach-buds are often killed on the lower heights, however, while heavy crops of this fruit are raised in the higher valleys among the hills skirting the foot of the mountain. Among the southern Alleghanies of North Carolina, fruit grown on the hillsides, above this frost line, is mostly secure from injury, and such is the protective influence of the warm stations that the Isabella grape has not failed

for twenty-six consecutive years to produce abundant crops, nor has fruit of any kind ever been known to be frost-killed, though there have been instances where it has been destroyed by a "severe freeze." There may be many such localities among the mountains of southern Pennsylvania, where the hardier grapes may be raised for many years with a good degree of success. The experiment is worthy of trial. If the story be not apocryphal, something has already been commenced in this direction, as appears from a recent notice of grape-growing in Blair county, Pennsylvania, in *The American Exchange and Review* for February, 1866.

Elevation is esteemed very important by many planters of peach trees near the Mississippi river, as their experience proves its value. An orchard near Alton, Illinois, 200 feet above the river, seldom fails to produce fruit, while all around the crop is frequently destroyed. On other orchards the spring frosts have destroyed all the buds within about ten feet of the ground, the line of death being as well defined as if levelled with a surveyor's instrument. At elevations varying from 20 to 250 feet above and bordering the Mississippi river, a difference of twelve degrees of temperature has often been observed on a still night. On the bluff of Lake Michigan, latitude 44½° north, 200 feet above the water on a knoll a few feet above the garden level, tomato vines were seen in blossom on December 1, 1865, though the first frost to destroy vegetation on lower levels had occurred on the 3d of October of that year. These results are all plainly attributable to the protecting agency of a canopy of buoyant vapor floating above and displaced by the cold air, which, descending to a lower level, has cut off the tender vegetation; and on this principle may perhaps be explained the moderate success which attends vine-growing on the hills which border the Ohio at sites judiciously selected.

On reviewing my long argument to sustain the belief that we have in the northern United States certain local climates clearly distinct in their range, and peculiarly fitted for the production of many tender and hardy fruits, and therein strongly contrasting with the climate of districts but little removed therefrom, and that these peculiarities are almost solely the result of the influences of the wide waters adjacent, I think my readers cannot fail to be convinced that the position has been sustained. Though with some the assertion may need no proof, there are others, and perhaps many, who never heard that our great lakes are of any use but for navigation, while there are some who believe them to be a great mistake on the part of the Divine Architect, and needing the improving hand of human genius! Despite the extraordinary value of the great lakes to the agriculture of the surrounding region, there are writers who scruple not to advance a most atrocious theory of possible improvements to be thereto applied. One of these engineers coolly proposes to fill up nine-tenths of them with earth! Hear his sage remarks: "If one could keep the Erie and Ontario at their present depth, and stretch out their apparently boundless expanse into good canals of moderate breadth, turn the land on each side into corn-fields, and keep every twenty miles as a broad square piece to form a basin attached to each canal—had nature adopted such a plan as this in the distribution of waters, or anything approaching such a grand ideal, I should consider it much more worthy of admiration than these great awkward basins that we ought to try and get rid of, or remodel as soon as we can!"

A theory so preposterous as the above could only have had its origin in the brain of one profoundly ignorant of the climatic value of waters to the territories adjacent—such ignorance as we have endeavored to remove. Far different from that presumption, which would arraign Omniscience, is the sentiment that would prompt to learn the wisdom of His ordainings, trace His beneficence in every arrangement, and humbly trust where it cannot understand. If we have not already shown, further research must prove, that these "wastes of waters," so termed, are not waters wasted, but have been stored for the use of man, to bless

him in many ways, some more obvious to his perceptions, others demanding closer inquiry, but equally advantageous to his comfort and his progress. It might be shown that they are gathered into the niches where they can most benefit the adjoining regions, in the latitude where their services were most needed; moulded in outline and arranged in concert for the widest extension of their blessings; scooped to the depth most conducive to the full conservative powers of their cool waters; raised to the height best adapted for that flow which shall gently press their floods onward to their outlets; placed where their ever-open bowls shall receive the blessing of the rains of heaven, and treasure or dispense them most wisely; and that, so far from requiring any changes to adapt them to human needs, they are, in their present condition, wonderful evidences of designs the most beneficent and far-reaching, planned for His creatures by the Divine Creator from the foundation of the world.

An article entitled "Observations on Atmospheric Humidity," intended to form an appendix to the present, has already appeared in the Report of the Agricultural Department for 1865. That paper assumes to explain, on sound principles, the cause of the variable climates of districts remote from water influences, as well as to indicate the best modes of remedying the evils of aridity, and preventing its increase. The reader desirous of extending his inquiries respecting the cause and cure of the difficulties to which our climate is subjected from deficient moisture, would probably consult that paper, after the perusal of the present attempt, with greater advantage than would attend their disconnected study.

COTTON CULTURE IN 1866.

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In accordance with the request of the Commissioner of Agriculture, I propose to embody some suggestions relative to the culture of cotton in 1866, the peculiar difficulties attending it, and "the necessity and advantage of the general introduction of labor-saving machinery to reduce the cost of culture, and to neutralize the embarrassments arising from the existing and prospective scarcity of labor."

I may premise that the natural history and true philosophy of the culture of the cotton plant have been my constant study for more than a quarter of a century; therefore I shall write not merely what I think, but what I know from personal observation and practical experience, for a series of years, on the cotton field.

It was but reasonable to calculate upon a comparatively short crop of cotton the present year. The plantations of the country were in a rough and dilapidated condition generally; stock, mules, and horses for plough-teams were scarce, as was also grain to feed them during the ploughing season, and in very many localities extremely difficult to procure, which, of course, measurably prevented the proper preparation of the land for planting. Then, again, most of the seed was old and imperfect from neglect during the war. From this cause few plantations obtained even a tolerable stand, and on many not until after planting over two or three times.

These discouragements at the very beginning of the crop started the cotton plant very late. Then again, to meet and encounter these serious disadvantages, the planters found themselves in the use of a new and untried system of labor, and the laborers generally disinclined to do full work. Superadded to this

already frightful array of difficulties attending the commencement of the crop, we had the most unprecedented amount of spring rain through the early summer that has ever been known in the cotton States, culminating in the great flood of June 10, which almost entirely drowned out the cotton plant on the rich river and creek bottom lands.

This long-continued, extremely wet weather not only injured the plant by a surcharge of water in the soil, thereby retarding its growth and rendering the plant more liable to succumb to the ravages of the *aphis*, (plant louse,) but promoted the rank growth of grass and weeds that proved seriously injurious to the crop in the acreage "*turned out*" to grass. This long spell of rainy weather was succeeded by sunny and dry weather, enabling the planters, by *unseasonable work*, to clear their crops—such as were not lost and given over—of the grass and weeds.

But this open dry weather, promising so propitiously in June, continued through July into August, and in many sections of the country to September, proving almost as destructive to the plant as did the rainy weather. In the beginning of September, the heavy summer rains commenced, and with them both the boll worm and the cotton caterpillar; the former destroying the bolls even half grown, while the latter stripped the plant of its foliage, blooms, and all young fruit, (bolls.)

Such is a brief statement of the "difficulties" attending the culture and production of the present very short cotton crop of the United States, which cannot much exceed the crop of 1836—thirty years ago, when Alabama and Florida produced comparatively little, and nearly ten years before Texas was a State of the Union. In a paper of this character, I cannot go into the minutiæ of these difficulties attending the operations of the past season.

In regard to these difficulties, an important question arises: Are they likely to continue to embarrass the culture of cotton for the future? To this question I answer emphatically that most of them will not; the plantations have received and are still receiving repairs for the next crop; the horse and mule force is being largely increased, and the planters have an abundant supply of good seed for the crop of 1867. Of the labor as much cannot be said; it is deficient in quantity, and in quality uncertain and unreliable.

Here we have a very serious embarrassment, that will not only continue, but will probably increase so long as we depend upon the freedmen in the culture of cotton. The other difficulties, of seasons, boll-worm, and cotton caterpillar, are natural, and not therefore entirely within the control of the planter; yet we may reasonably hope that Providence will in the future dispose them as in former years.

I now come to the proposition that labor-saving machinery is essential to future improvement in cotton culture; and I am gratified to be able to bring to its discussion an experience and practical observation, on the field, of more than twenty-five years.

As early as 1840 I saw the fallacy and destructive effect on the soil of the country of the common system of cotton culture; and at that time I instituted and commenced putting in practical operation a series of experiments founded upon philosophical principles: first, in the preparation and artificial fertilization of the soil; and secondly, in the subsequent culture of the cotton plant. In 1842, with the disadvantages of slave labor, while this system was yet crude and not fully perfected, I grew upon a single acre of thin or poor (naturally) sandy pine land nearly 6,000 pounds of seed cotton. This crop was grown by first applying a heavy dressing of good compost manure (barn-yard) broad-cast on the land, which was then laid off in five feet rows and bedded out with a good turning plough very deep.

The position of each plant in these rows or beds was spaced exactly three feet apart, and a half gallon, or spade full, of good compost manure deposited in

each hill or position to be occupied by the plant. On the 10th day of April the seed was planted, after being first rolled in ashes, by dropping half a dozen in each place. The only difficulty here, and it was a serious one, the seed being placed in immediate contact with the manure, was the destruction of the vitality of many seeds while vegetating, and I obtained a bad stand at first; but by a quick perception of the difficulty and determined perseverance, I very soon obtained a perfect stand. The culture consisted of one light ploughing, while the plants were yet young, with a common shovel plough, and afterwards entirely with the weed hoe and a sweep running very shallow. Subsequently, and in the perfection of the system, I have abandoned placing any manure in the hill, but apply it broadcast entirely, which secures a good stand at first planting.

Here you have a brief yet plain and simple statement in detail of the mechanical and operative manual labor process by which this new and improved system of cotton culture is conducted in the field. The philosophy and science upon which the system is based, I shall show to be equally plain and simple, and easily to be comprehended by any laborer of good judgment and ordinary intelligence.

This may be first stated in brief previous to illustration. A farmer desires to produce upon a given area of ordinary common cotton land, say one or more acres, two or more bales of cotton to the acre. It is first necessary to incorporate with the soil a sufficient quantity of phosphoric acid in a soluble form, which the cotton plants may take up from the soil and assimilate into cotton seed, bearing the proportionate quantity of lint (cotton) for the desired bale or bales. This is conveniently had in good barn-yard compost or a good and genuine article of superphosphate of lime.

The illustration here is more satisfactory by taking a practical example. For instance, an intelligent farmer or planter, with his family located on his own little farm, or on a leased one, proposes to raise five bales of cotton, weighing 500 pounds each, the next year; this he intends to do on five acres of ordinary cotton land. His intelligence and judgment prompt him first to lay his level on this little field and bring his cotton rows to a horizontal. That same intelligence teaches him that the elements of plant food for five bales of cotton do not exist in a soluble form in the soil of his five acre field. What then? He has already prepared, in and from his stock yards and stables, 500 bushels of good compost manure for each acre, which any planter may do at two cents per bushel; if he has it not already prepared he purchases one ton of superphosphate, pure and genuine, which he uses instead of the home-made compost. This is hauled out and spread uniformly over the soil, and then with a two horse "Brinley Eagle," or some other good turning plough, he beds out his rows deep and thoroughly, intimately incorporating this fertilization or plant food with the soil, at the same time effecting the proper and necessary pulverization. This beautiful process accomplished, his five acres of ordinary cotton land become the repository of the available elements of five bales of cotton. At the proper time, between the first and fifteenth of April, he plants his cotton seed; it now becomes necessary that the planter exercise his mechanical skill and judgment in the operation of planting; he is satisfied that he has stored in the soil of this field the crude elements of five bales of cotton, which field, before being fertilized, under the ordinary system of culture, might have produced but 250 to 300 pounds of seed cotton per acre. Now to secure five bales of cotton from it, a certain number of plants must be had standing on it in an even and uniform relation to each other; in other words, this being the first year of the shift or rotation, (this system embracing a beautiful and most profitable method of rotation of crops, as was successfully practiced by myself,) a bale of cotton only is intended to be had from each acre. For this end his rows are laid four feet wide, and the seed planted by spacer (compass) or seed planter thirty inches apart on the row. This gives him 4,368 cotton plants to each acre, taking seventy yards square as the acre. Thus he has on each superficial square of ten feet throughout each

acre a cotton plant, thereby securing to each plant its natural (pyramidal) form and continuous healthy growth to perfect maturity; hence there is here no crowding of the plants, nor is there any space unoccupied. And here allow me to remark, emphatically, that this natural (pyramidal) form of the plant is absolutely essential to its perfect maturity. It is not possible for this uniformity and perfect stand of plants to be had by any other mode or system of culture yet devised.

Another short paragraph will simplify this illustration. Take, for instance, an acre of common cotton land anywhere in the cotton region proper, seeding it with wheat, and give it the necessary fertilization and culture for the production of 1,800 pounds of grain, (30 bushels;) a result easily attainable. Then take an adjoining acre of the same character of land, with the same fertilization, and plant it with cotton seed, cultivated in all respects according to this improved system, and it will produce the first year 1,500 to 1,800 pounds of cotton seed; with this important addition, that from the atmosphere the cotton plant clothes the seed by assimilating its carbonic acid with 500 pounds of snow-white lint or cotton.

Here we have an improved system of cotton culture, practical and certain in its results, entirely adapted in every operation to "labor-saving implements and machinery." The land may be thoroughly ploughed with "gang ploughs," the seed dropped and covered at regular distances apart in the rows by seed planters, when all the subsequent work in its culture is just such as the intelligent gardener applies to his enriched soil in growing his superior vegetables. This system of cotton culture commends itself to intelligent laborers and their families; its various operations are comparatively light, (five acres to the hand.) Then again its highest recommendation consists in its permanent improvement of the soil and the bountiful crops of grain it secures to the planter. This five acres, after the cotton is picked off, has returned to the soil the leaves of the cotton plant, the burrs, the stalks, and the seed, except three to four bushels for planting other five acres the next year.

The rows being laid level, neither the enriched soil, nor the debris of the cotton plant returned as above to the field, can be washed off by the rains. This five acres the second year is planted in corn, which yields readily, of an ordinary season, 40 bushels of corn per acre, or 200 bushels to the hand.

The third year it is seeded to wheat, rye, oats, or any small grain crop the farmer may desire. With a light dressing of plaster or superphosphate, (the latter preferable,) an entirely remunerating yield is obtained.

The fourth year it lies in grass fallow, to be disposed of through the season as the interest of the farmer may require.

COTTON PLANTING.

BY JOSEPH B. LYMAN, LATE OF LOUISIANA.

SELECTION OF A COTTON FARM.

Three or four considerations of a general character must be taken into account by every person who proposes to enter upon the business of producing cotton. The first and most important of these is climate. Cotton will grow and yield a few mature bolls as far north as the latitude of Philadelphia. It has been cultivated to quite an extent in Maryland and Delaware, and in the southern part of New Jersey. West of the Alleghanies, it will grow in southern Illinois, and in

northern Missouri; but the result of the experiments of 1862 ought to be candidly stated, and it may now be considered a settled question in American agriculture that cotton must command very high prices, (from fifty cents to a dollar a pound,) to prove a paying crop north of the thirty-sixth parallel. In other words, the line drawn through Nashville, Tennessee, and Raleigh, North Carolina, divides the country into two sections. In the northern portion cotton is profitable only when it commands war prices, and south of this line its growth will be lucrative until it falls below ten cents a pound; but this line is not the northern limit of the cotton belt proper. In the valley of the Mississippi one must go below Memphis to find an entirely suitable climate, and on the Atlantic seaboard he must go south of Cape Hatteras. The western limit of the cotton fields of the United States is a line passing north and south through San Antonio, in Texas. The extreme length of this region is nearly fifteen hundred miles, and its width a little over three hundred, thus giving four hundred and fifty thousand square miles, in the greater portion of which a location for a cotton farm may be chosen.

In the northern parts of this belt—that is, in the region lying north of Atlanta and Columbia, in the east, and north of the mouth of the Arkansas, in the Mississippi valley—the farmer proposing to raise cotton as one of his crops can easily associate with it the production of wheat, oats, clover, sorghum, and the growth of apples, pears, and other fruits found throughout the northern part of the temperate zone. In the southern part of this belt, Louisiana, Florida, and the lower part of Texas, the cereals, except Indian corn, have never been considered profitable crops, and the fruits met with are of a tropical or semi-tropical character, such as the orange, the lemon, the fig, and, in Florida, the banana and pineapple. Cotton is essentially an exotic in all parts of the United States. It is a tropical tree with a life which naturally extends throughout a number of years, but, transplanted to our soil, it becomes an annual instead of a perennial; and the vigor of the plant in place of producing woody fibre, as it does in the tropics, is expended in the multiplication of its pods; hence the best part of the cotton zone is the comparatively narrow belt, where the winters are severe enough to produce ice and frozen ground at intervals during about two months of the year, and the summers are long and hot. Another requisite of a good cotton climate is that the relations between the mountains and the sea, and the moist winds that blow from it, may be such as to give abundant rains in spring, followed by frequent but not violent summer showers, and an autumn that, for months, is almost entirely rainless. The lower part of the Appalachian range, running diagonally across the country, and producing high lands in the northern parts of South Carolina, Georgia, Alabama, and Mississippi, which slope gently down to the Atlantic and the Gulf, gives the climate described to all the cotton States that lie east of the Mississippi. The Osage mountains, which extend in a southwesterly direction through southern Missouri, northwestern Arkansas, and become hills in northern Texas, produce a similar climate in the region west of the Mississippi.

When a person has determined to engage in a cotton-planting enterprise somewhere within the limits of this extensive tract, the next practical question for his decision will be whether, all things considered, it is advisable to select alluvial or river bottom lands in preference to a soil somewhat less fertile among the hills. Fifteen years ago by far the greater part of the cotton crop of the United States was produced on hill lands; probably one-half of the crop of 1860 grew upon lands within cannon-shot of some of the streams that debouch into the Gulf. From 1850 to 1860 the tendency of the agricultural capital of the South to desert the uplands and transfer their labor to the inexhaustible soil of the river bottoms was marked. In a general way it may be said that an acre of the best alluvion will produce twice as much cotton as an acre of ordinary hill land, and that under even the most careless system of culture the alluvion will continue to produce successive crops of cotton for generations, without any material decline of fertility, whereas ten or fifteen years of careless and unscientific planting upon

hill lands will render them comparatively worthless. This seems to indicate a very great superiority in river lands; but there are several facts, by way of off-set, which should be candidly stated:

1st. The alluvial lands of the south, and particularly of the southwest, are all heavily timbered, and it requires a considerable amount of capital to open them, and those already opened and in cultivation command a high price.

2d. As a rule, the valleys immediately bordering upon all the streams that pour into the Gulf are miasmatic. Covered as they are with rank vegetable growth, and saturated by the heavy rains of winter and spring, and quite frequently by inundations, when the fierce sun of this semi-tropical climate is poured upon them, an exhalation is produced, which, under the most favorable circumstances and in the most vigorous constitutions, will cause some derangement of health, and often acute illness.

3d. The greater portion of the lands on the banks of the Mississippi and all its larger tributaries, and also of most other southern streams, are liable to become submerged by spring floods.

In the Mississippi valley this inundation would be annual, and almost universal, were it not for a levee system, which is very expensive and never affords entire security from water. In a great number of minds these serious objections to the river lands for cotton-planting purposes, more than balance their superior fertility. Although previous to the war there was a strong tendency in capital and labor to desert the hill lands, they are by no means exhausted, and millions of acres of southern uplands are still covered with aboriginal forests. By proper inquiry and search it is not difficult now to obtain cotton lands at reasonable prices, which, though situated above overflow, produce almost as well as the best alluvions. The fine black cane lands of middle Alabama, for instance, cover an area of about two millions of acres, every acre of which is capable of producing four hundred pounds of ginned cotton annually without manure; and the black rolling prairie lands of Texas are of much greater extent and of equal fertility. With these general suggestions as to the selection of cotton lands, let us pass to a consideration of the

STOCK, LABORERS, AND IMPLEMENTS OF THE COTTON FARM.

The cultivation and harvesting of a cotton crop requires hardly any peculiarity in the form of the ordinary implements of husbandry. Several large cast-iron ploughs, capable of cutting a deep furrow, are required for the first ploughing. After that, the entire cultivation can be performed by light implements, the form of which will be mentioned hereafter. An ordinary light hoe is suited to cotton culture. Some small harrows would be required. For draught animals on a cotton farm, mules are preferable to either oxen or horses. The plough labor in the cotton field is not heavy, but it is greatly protracted, lasting through at least four months, during which the animals must be in traces almost every day. This steady and monotonous toil, under a blazing sun, is much more exhausting to horses than to mules. In selecting mules, size is not generally an important recommendation. A mule that is compactly built and hardy in his temperament, and having a rapid walk, is the best animal for the cotton field. All the movements required in cultivating cotton are light and brisk. The ground is to be stirred frequently, but not to a great depth after the first ploughing; consequently, animals that have a brisk gait are far more effective and valuable in this crop than such as have a heavier build and slower movement. As a rule, a mule and a laborer may be calculated as necessary for every ten acres. If the soil is superior, as a river bottom or black prairie, the planter may expect a bale to the acre. If his lands are light and considerably worn, from two hundred to three hundred pounds per acre is all he may calculate upon; hence, on such lands he may put in fifteen acres to the hand, provided his laborers are good cotton-pick-

ers. It requires a good picker to gather ten bales in the picking season, and, of course, this can be done with greater ease from ten acres than from fifteen. It is never advisable to put in very large crops, unless the labor supply is such that the hands regularly employed on the place for the year can be considerably re-inforced during the picking season. It requires no remarkable industry for a hand to cultivate from ten to fifteen acres in a light free soil, but he must be a very active picker in order to harvest the crop that should grow upon this surface. Except in very wet seasons, and on soils foul with grass and weeds, the cotton crop will allow of sufficient intervals for the planting and cultivation of a crop of corn, potatoes, oats, and the usual garden vegetables, sufficient, at least, for the home consumption of the stock and laborers on the farm. The sweet potato flourishes on all soils suited to cotton. It can be cultivated when the weather is too wet for labor in the cotton field, and an acre in sweet potatoes produces three or four times as much nourishment, for man or beast, as the same acre planted in Indian corn. With regard to laborers of whatever race, the man of moderate size and quick movement is a better hand than one who is powerful but slow. Throughout the year, in all stages of cultivation and harvesting, cotton requires a light brisk movement and patience of monotonous toil. On this account women are generally as effective, and often more so than men, as laborers in this crop. When the picking season comes on, (and that is the only time when there is a steady pressure upon the whole force of the place,) the woman is, as a rule, swifter in movement than the man, equal to him in patience, and those of the African race, at least, prefer to labor in the open air. With regard to white labor throughout the year in our cotton fields, this much may be safely affirmed, that in the uplands, even as far south as to the middle of the cotton belt, probably one-half of the crop always has been cultivated and picked by white hands, the plantations where the Africans labored exclusively being mostly the fertile and miasmatic valleys of the principal rivers for one hundred or two hundred miles above the ocean and the broad alluvions of the Mississippi bottoms.

The average heat of Columbia, South Carolina, and Atlanta, Georgia, is about the same as that of western Kentucky and southern Illinois. Besides, the farm laborer is not driven from the field by the heat of the sun during so many months as he is excluded from out-door labor by the frosts and snows of higher latitudes. The number of days during which a laborer can pursue his industry in the open air, is certainly as great in Georgia as it is in New York. Another circumstance is of great importance as respects the particular crop under consideration. The busiest months in the culture of cotton are April and May, during which there are but few days of intense heat. In June, July, and August a few hours' labor early in the morning, and as many more in the afternoon, will keep the crop clean, so that the white ploughboy and his horse or mule can come in from the midday heat at ten, and remain in the shade till four in the afternoon, without neglecting the crop.

HOW COTTON SHOULD BE PLANTED.

Where the field is foul with weeds or the stalks of last year's crop, it is best to bury them under the middle of the cotton ridge, and it is recommended to run a double furrow at intervals of four feet in hill lands and at intervals of five or six feet in bottom lands. This can be done early in January, whenever the ground is not too wet. Behind each plough are two hoe hands, to break up and pull down into these ditches all the dead growth of the surface, one from the right side and the other from the left. Let it be well pulled down into the trench and covered with some earth to keep it in place. Then, about the middle of February, according to situation, latitude, and drainage of the land, let the double ploughs set in to break up the entire surface. If the rows for burying the trash are uniformly laid off, they can be used as the foundation of the bed or ridge.

Throw a deep furrow from each side into the trench, filling it and covering all the trash, and continue to plough out the intervening spaces or middles, as they are called, until the whole surface is turned under. This ploughing should be deep and thorough. If compost or barnyard manure is applied to the field it should be done just before ploughing, and scattered broadcast. If concentrated fertilizers, such as ashes, guano, gypsum, or superphosphates are to be used, they are best applied in the drill. In respect to fertilizers for the cotton field, it may be here remarked that cotton is a moderate consumer of the salts that nourish plants, especially if the seed is returned to the soil, as it should be, in the form of manure. Potash and phosphate of lime should abound in any manure applied to cotton. The effect of an abundance of potash in the soil will be to secure thrifty plants. The effect of a generous supply of phosphoric acid is to produce large seeds and a fine strong staple. This first thorough ploughing is likely to be interrupted, so that it may not be concluded until after the middle of March. The interval between ploughing and planting should be utilized by the farmer in getting under way his crops of corn, oats, and potatoes. From the first to the twentieth of April is the planting time of cotton. The old rule, and one easily remembered when once heard, is, "Plant your cotton when the leaf upon the oak is as big as a squirrel's ear." The ridges, which were formed a month or six weeks before, have become somewhat flattened and are hardened by rains, and they should be well broken up by running a small fine-toothed harrow over them once or oftener, according to the tenacity of the soil. After the harrow there should follow some suitable instrument for marking a smooth uniform drill for the reception of the seeds. The planter cannot be too particular about this. The best planters are those who are the most scrupulous about having their rows uniform in width and the plants in a straight line in the row, for the entire subsequent cultivation is rendered much easier by it. Some open the top of the ridge with a light plough, but this makes a drill too ragged and uneven. There is an implement manufactured near Atlanta, Georgia, which marks a line for the seed, drops and covers it, and is said to do its work very well, but this is not in general use. Our cotton interests would be greatly facilitated by the invention and extensive use of a good cotton-planter. A simple and effective instrument is a triangular piece of wood, measuring four or five inches on each face, with plough handles fastened into it and carefully held on the top of the ridge. This makes a smooth-sided, well-defined drill, and the seeds when dropped into it will roll to the bottom. It is well to soak the seeds a day or two before planting and roll them when damp in a mixture of plaster of Paris. They can be dropped from a basket or bag, and the best manner of doing this is by throwing four or five in a bunch at regular intervals of fifteen or twenty inches apart, and this interval can be very well measured by a short step. The seed need not be buried deep. The whole process of planting needs careful supervision, and should be performed only by a reliable and conscientious hand. If a foreman is standing at one end of the rows, the freedman (and as likely the white laborer) will start off very well, dropping the seeds uniformly and getting them well into the bottom of the drill; but after he passes along out of sight he is quite likely to grow careless, and in two weeks after, the planter will be annoyed to find his seeds coming up in irregular patches. Hence thorough supervision is earnestly recommended. The distance of the rows from each other, and the intervals of the plants in the row, should vary with the fertility of the soil. The rule for uplands is four feet between the rows and twenty inches between the plants. In lands that are strong enough to yield a bale to the acre the spaces should be five feet one way by three the other, while in the teeming and almost tropical valleys of the southwest, such as the Red river and Brazos bottoms, the luxuriance of the growth is such as to require an interval of eight feet between the rows and of five or six feet between the plants, and even then the branches interlock so that it is difficult to walk between the rows.

CULTIVATION OF A COTTON CROP.

Cotton differs from almost every other plant cultivated in this country in the length of the season required for reaping the full profits that may be derived from it. This results from the fact that cotton is, in its nature, a perennial, and consequently displays no alacrity in maturing its fruit before frost, hence the necessity, on the part of the farmer, of pressing the advancement of the plant as rapidly as possible during the summer months.

The great desideratum with the cotton planter is to obtain the longest possible period for his harvest season; consequently during the early part of the summer his policy should be to press the crop and obtain open bolls early in August, so that the pickers may start in with their bags and baskets by the fifteenth or twentieth of that month. The first cultivation the crop receives should commence about fifteen days after the planting. If the instructions given above, with regard to evenness of rows and of the intervals between the plants are followed, the first cultivation may be easy and rapid. A light plough should be run close to the line of plants, cutting away the weeds and grass and stirring the earth to a moderate depth. The hoes follow, smoothing the inequalities produced by the plough, and clearing the intervals between the clumps of young plants. In the ordinary mode of planting, when the seed is scattered thickly through the drills, this first cultivation is called "chopping out." Two weeks after the hands should go over the crop again, thinning out the young plants to a stand. This is sometimes done at the first cultivation, especially in strong soils. This second cultivation should be the most thorough of any, the thriftiest plants only being spared, and the rest being pulled up with care so as not to displace the roots of those allowed to remain. A little fresh earth is thrown around the roots of the young plants, and the entire ridge, as well as the intervals between, should be made perfectly clean. On a good soil, with favorable seasons, the growth will now be rapid, and the subsequent cultivation can be effected mainly with the plough. Here it should be remarked that deep ploughing, except when the land is bedded up for a crop in spring, is never beneficial. It breaks the lateral roots of the plants, and this retards the development of the pod and curtails the picking season, hence, the best plough for cultivating cotton is one which, instead of turning the soil, scrapes the surface of the earth. The implement in common use is very well adapted to this purpose, and consists of a common scooter plough, with wings attached three or four inches above the tip, and set in such a way as to pass just beneath the surface and throw a little ridge of fresh earth close to the stems of the plants. They often, when skilfully used, clean the surface so thoroughly that the hoes can pass over the crop very rapidly Sometimes early in the month of July, on a good soil, the plants will be so far advanced that the boughs will touch and perhaps lock across the middles. Many planters think that little is gained by running the ploughs after the crop attains this growth, but the more the ground is stirred the more readily will the heat of the sun penetrate the soil and fall upon the roots of the young plant, and this is what is required to hasten their development. No rule can be laid down as to the number of times the farmer should go over his crop, as the cultivation must vary with the season and the condition of the soil. All the movements in the cotton field should be brisk, so that the force may pass along over the crop rapidly. Cotton is a very jealous plant and will not struggle with weeds or grass for a division of the fertilizing properties of the soil. It will not grow unless kept very clean and the full energy of the soil is kept concentrated upon it alone.

ENEMIES OF THE COTTON PLANT, AND HOW TO DESTROY THEM.

While young and tender the cotton crops may be considerably injured by the depredations of the cut-worm—a small brown insect that nips the plant just

where the stalk enters the ground. Several modes of treatment have been suggested as preventives for this pest. Probably the most effective remedy that can be applied, after the crop is up, is to give the young plants a top dressing of ashes, which should be blended with the earth around the roots. Some planters in Louisiana have relieved their fields from the ravages of this vile enemy of the great staple by ploughing their cotton fields very late, just before planting time. Others recommend the sowing of an abundance of seed, so that there shall be a stand left after the plants have grown beyond the reach of the cut-worm.

The *cotton louse* and the *rust* are also prone to attack the plant in its infancy. Brisk cultivation and a top dressing of ashes and plaster of Paris are the best remedies for both. Rust is generally the worst in soils of moderate depth, which have been planted in cotton for a number of successive years. Rotation of crops and a liberal application of manures, especially those that are rich in potash and phosphoric acid, will, in nine cases out of ten, relieve the cotton field of this malady. It is not until the plant has nearly reached its growth, and in many cases begun to whiten for the harvest, that cotton is liable to the onset of its three most destructive enemies. These are the boll-worm, the cotton-worm or caterpillar, and the army-worm.

The boll-worm is an insect generated by a pale yellow moth or miller, which deposits its eggs on the topmost buds of the plant, or at the extremities of the side branches. It prefers corn as its pasture ground for its young, and the first generation is produced when that crop is setting the ears, which is within a week or ten days after it commences to tassel. The little worms, hatched from eggs thus deposited, feed upon the tender silk and ear of the corn, and soon descend to the earth and assume the chrysalis state. This lasts two weeks, when the second generation of millers makes its appearance. Finding no corn in a suitable condition for their purposes they fly to the cotton field and deposit their eggs on young bolls. Vast numbers of these eggs are scorched by the hot sun or destroyed by ants; but some are hatched even in the dryest seasons, and the little worms commence their ravages. When very young they frequently eat into the flower-bud; when older they attack one boll, then another, and so on until seven or eight bolls are destroyed. The worm then descends and burrows in the ground, forming a chrysalis, and in turn a third generation of millers; but their ravages are generally abridged by the maturity of the bolls, and the coming on of frost. There are two or three ways of preventing the ravages of this little pest. One is by planting at intervals through the cotton field a row or two of late corn.

The miller always prefers corn if she can find it, and by providing her a supply of this plant, which is very little injured by her progeny, the adjacent cotton plants would mostly escape. Another method is by destroying the miller. This is done by kindling fires at the edges of the field, about dusk and early in the morning, to which they are attracted and by flying in are burned. As the moth does not fly in the hot sun, excepting when disturbed, but does her mischief about twilight, much may be accomplished by passing between the rows, about sunset and early in the morning, with broad paddles or small hand nets, with which the insects are knocked down or caught and killed. Hands soon become quite expert at this, and by moving about through the crop two or three hours twice in the day can so reduce the number of the millers that their effect upon the crop will be inconsiderable. As they are known to lay their eggs on the tips of the plants, it is a very good plan, when they are frequent over the field, to clip off the branches upon which they are likely to have made their deposits. . This topping of the plant is believed by some to increase the number of the bolls, and by doing it at the right time great numbers of the eggs may be destroyed.

The cotton-moth or caterpillar is produced from a miller about an inch in length, whose breast is of a dull silvery white, terminating on the abdomen and wings in a russet color. The upper surface of its wings and back are of a change-

able golden hue, with zigzag lines of the color of iron-rust, their back margin being of a pale pink color with small notches. There are two black spots on the upper surface of its wings. This insect, as well as the worm that it breeds, differ from the boll-worm in being strictly confined to the cotton plant. It must perish if it does not find a cotton field upon which to feed. The first generation is small and confined to a limited area. The worm, which is hatched from eggs deposited by the fly, feeds upon the leaves of the cotton plant for a few days and then burrows in the ground, changing to a chrysalis, from which the second generation of millers is bred. These are much more numerous than the first, and the worms produced from their eggs, if suffered to hatch, will devour every leaf in the field and ruin the crop as completely as a killing frost. The boll-worm damages the boll alone, the caterpillar devours the leaves, and frequently the boll also; hence the latter should be fought from the first moment of its advent. The farmer cannot be too vigilant in watching for this ruinous little fly, with whose appearance and habits he should make himself familiar. There are two modes of attack, one upon the fly, the other upon its eggs. The plan recommended for the moth that breeds the boll-worm applies as well to this miller. If fires are lighted upon little platforms covered with earth and raised above the tops of the cotton in various parts of the field, great numbers will be attracted to them and destroyed in the flame. Many have found it a good plan to distribute plates set upon a little cap nailed to the top of a stake, quite thickly over the field, and partly filled with a mixture of cobalt and molasses, or molasses and vinegar. One planter in Alabama states that with eighty plates he has averaged over one thousand flies every night, and some have taken as many as seventy from one plate, caught during the night. In connection with this, many send their whole force through the fields every morning and evening with broad light paddles or hand nets. In this way great numbers may be killed. Another, but rather tedious, mode of exterminating this pest is by examining the plants for the leaf upon which the eggs have been deposited. A few days' practice will train the eye to be very quick in detecting such leaves. They are picked, carried out of the field and burned or buried. Fortunately it is a leisure time with the cotton planter at the period when these enemies of his make their appearance, and by operating against them in all these methods he can, if his exertions commence in time, exterminate all but a few stragglers of the invading force.

The *army-worm* is an omnivorous insect. He devours every green thing. As his name indicates, he marches in solid column, and can be fought most effectually by the spade. When apprised of the approach of the army-worm, the planter should lose no time in digging a ditch on the southern side of his field and on the east and west flanks. This insect seldom or never travels from the north. A ditch of a foot in depth will turn him, for he cannot scale a smooth earthen wall. It is well to cut the inside face of the ditch a little sloping in, and this face the worm certainly cannot climb. If the army-worm commences on a field the planter cannot be too prompt or energetic in his movements. Let him mark out a line a few rods in front of the advancing host and have two or three rows of cotton pulled up and thrown towards them. While they are eating through this *chevaux de frise* he will have time to sink a ditch, which he must actively deepen until its interior surface is sufficient to check their march. It is a safe precaution, which a great many planters have adopted, to surround the entire plantation with a ditch as above described, and then, when reports of the advance of the army-worm reach him, he has only to clear it out and cut down its sides to a smooth surface in order to feel secure.

COTTON PICKING.

In the most advanced fields on the southern margin of the cotton zone, picking may commence early in August. In Tennessee and the northern part of

Alabama and Mississippi the month of September may be somewhat advanced before many open bolls are to be seen. From this time on, for three or four months, cotton picking may be said to be the sole occupation of every industrious person on the place. The foreman or proprietor should see that every hand is supplied with the necessary facilities for pushing his labor to the very best advantage. The baskets into which the bags are emptied should be so placed that the picker should start from them, go out on one row and return on the next, the rows being short where the cotton is thick and well open, so that he will not have any unnecessary weight to carry on the last half of his bout. To secure these advantages it is recommended to select roads at proper intervals, unless the field itself is long and narrow. During the picking season the mules and horses on a plantation have very little to do, and it is advisable, where the fields are remote from the house, to take the hands out to their work in the morning and bring them in at sunset. Considerable time is thus saved, and there is a greater economy of strength and spirits. It is worth while also for the planter to devise improvements in the bag which is to be carried for four months by the cotton picker. The form which has been almost universal throughout the south is simply a yard of coarse muslin closed at one end, with a strap of the same material fastened to the sides, to be passed over the shoulder. This arrangement is quite too rude and awkward. A much better receptacle for the cotton as it is picked would be a shallow reticule, made of stiff canvas or of leather, belted around the waist and held up by straps crossing over the shoulder. Let it be made in such a way that the top will constantly stand open and extend all around the front of the body. By making it long it need not be so deep as to interfere with the movement of the legs. Formed thus, it would leave all the limbs free in their motions, and the distance that has to be passed in carrying a handful of cotton from the pod to its receptacle would be very much abridged. It is a very good plan for some person, who may be too old or infirm for active labor between the rows, to sit by the baskets and pick out the trash which has found its way into the bag in haste of rapid picking. It is necessary to dry all cotton that has been picked after a rain or when heavy dew is on the field. This should be done on a scaffold, erected for the purpose near the gin-house or cotton-sheds. It is not best, however, to sun cotton too long, as the essential oil which is drawn into the fibre from the seed, giving it greater weight and imparting to it a fine, pale straw color, is thus evaporated; nor is it advisable, on that account, to gin cotton as soon as it is picked. It is better for it to stand a number of weeks in the seeds in the cotton-sheds, allowing time for the oil to infuse itself through the fibre. Success in harvesting a cotton crop depends very much on the alacrity of the force employed in the field. As before stated, cotton-picking, though light work, is very monotonous, and yet can only be successfully accomplished by rapid movements. If a set of hands become discouraged and low spirited, the rate of their motions will constantly diminish. The foreman or the proprietor on a cotton place should take means to prevent this. Let the hands be kept near together, the most rapid pickers turning, at times, to the rows of those that cannot pick so fast, and helping them along. It is bad policy to allow a set of hands to straggle and the slow pickers to fall far in the rear of the best hands. If left thus alone, behind the rest, they become discouraged and their picking falls off from bad to worse. Hands thus engaged should be fed well and frequently. If they are laboring on a miasmatic soil it is policy to give them a cup of coffee the first thing in the morning. The coffee should be boiled twenty minutes or half an hour to extract all its anti-miasmatic properties, or those in which it resembles quinine. Besides the cup of hot coffee, the hands should have a piece of bread or a sandwich if they labor one or more hours before breakfast, as is the custom. By cheerfulness, a full diet, and avoiding the extremes of the daily temperature, it is not difficult for laborers of whatever race to preserve very good health in the cotton field. As the season advances the

days are shorter and rains are somewhat more frequent and much more injurious to the staple; hence the cotton-grower should feel the importance of being as active as possible in the early part of the season—that is to say, during the months of September and October. By the twentieth of September he will know, almost to a certainty, the amount of the crop he has to gather. He is then beyond the reach of almost any agency that can materially lessen the number of bales. Hence if, at that time, there is a disproportion between the number and activity of his pickers and the amount they have to gather, he should take the most active measures to reinforce them. As above stated, a good hand can cultivate fifteen acres in cotton more easily than he can harvest the crop from ten acres. Unless the proprietor feels a great deal of confidence in his hands as rapid pickers, whenever his crop is full he ought to reinforce them considerably. For instance, if the soil is strong and the season has been favorable, he may calculate that it will require fifteen pickers to take out the crop that has been planted and cultivated by ten hands. The revolution in the southern system of labor which has occurred in consequence of the war, will no doubt manifest itself conspicuously in this respect. Hitherto there has been no practicable manner in which the picking force of a place could be reinforced. In future there will be a large class of laborers who, during eight months of the year, will be engaged in miscellaneous arts and industries, whom high wages and the certainty of steady labor for four months will draw into the cotton fields.

GINNING, BALING, AND MARKETING.

Up to this point in the production of a crop of cotton no expensive implements or difficult processes have been demanded. In order, however, to prepare the staple for a distant market it must be separated from the seeds, packed in firm, solid bales and forwarded to a shipping port. There is great difference in the practices of planters as to the skill and thoroughness with which these concluding steps in producing a crop of cotton are conducted. A gin consists of a series of fine-toothed circular saws fastened upon a wooden cylinder about three-quarters of an inch apart, and revolving in slits cut in a steel plate, less than a quarter of an inch wide. A mass of cotton in the seed is laid upon this plate. As the saws revolve, the teeth passing down between the openings, they pull off the lint from the seed and carry it through with them, the openings being narrow enough to prevent the seed from passing through with the lint. On the lower side of the cylinder set with saws, is a revolving brush which takes off the lint as it comes through on the saw teeth, and a blast from a revolving fan carries it back through a flue into a lint room in the rear of the machine. This is the essential principle of the famous Whitney gin, which revolutionized the agriculture of the south half a century ago. Without such an invention cotton would not have been more important, as an article of export from the south, than beeswax. Two pounds a day is a very good performance for hand picking, while a good gin can easily separate three thousand pounds of lint from the seed in twelve hours. The excellence with which a gin does its work depends mainly upon the number, pitch, and shape of its teeth, and every cotton planter should be enough of a mechanic to understand the practical effect of differences or defects on these points. Coarse teeth pull off more lint than fine teeth, but they do not perform their work as well, and require much greater driving power. The coarsest gin saws are cut with six or eight teeth to the inch, the finest with sixteen, and the majority have ten or twelve to the inch. Very much also depends on the angle at which the tooth projects forward from the saw. If that angle is very sharp, so that in revolving the tip of the saw tooth passes below the face of the steel plate before the base or throat passes, the effect of such a gin will be to pull off the lint rapidly, but the staple will be more or less torn and matted, and thus considerably damaged. If, on the other hand, the angle is very obtuse, so as to

look like an ordinary wood saw, it will hardly gin at all. The medium in this respect should be carefully observed, and the teeth filed in such a way that the front face, which carries the lint with it, shall be precisely parallel to the plate at the moment it passes down through the slit. Care should be taken also not to have the inner angle of the tooth too acute. It should be filed out a little rounding. It has been the custom to drive gins too rapidly and feed them with matted masses of cotton. When this is the case, and particularly if some of it is a little damp, the cotton is liable to be a good deal injured in ginning. Mr. Pratt, of Alabama, who has had thirty years' experience in the manufacture and use of gins, says that a machine that cleans but one or two bales in a day, is decidedly better than one which gins seven or eight bales a day, and that rapid ginning has been an almost universal fault among cotton growers hitherto. The annual amount that can be ginned by a machine varies also according to the number of saws it carries. Few, if any, are made with more than eighty saws.

The gin may be set upon the ground and driven by horse-power, after the manner of a threshing machine, or a number of gins may be placed side by side and all of them driven by a steam engine. Between the rudest and most temporary arrangement, by which a crop is ginned in a large walled tent, and a thoroughly built steam gin-house, with every appliance for doing the work in the best manner, there is every grade of convenience in the size, arrangement, and value of southern gin-houses. By far the greater portion of the cotton crop of the United States is ginned by horse-power. The draught is applied at the ends of two levers fastened into an upright shaft, to the upper part of which is attached a large cog-wheel playing upon a ratchet. This carries a drum, from which a leather or gutta percha band passes to a small wheel not more than a foot or eighteen inches in diameter, which drives the cylinder and saws. The gins are placed in the second story, immediately over the revolving vertical shaft, and the lint is thrown back into the lint-room, beneath which is a screw or press of some kind for making the cotton into bales. The third story or loft is used for storing cotton that has been sunned or was gathered dry. In addition to these essential parts of a gin-house, there are cotton sheds of greater or less dimensions, some immediately attached to the building and others at a little distance. The gin, or gin stand, as it is usually called, costs from $125 to $250, according to size, number of saws, fineness of teeth, and care in the construction of its parts. The necessary machinery for driving it can be made by a wheelwright for about five hundred dollars. A very frequent size for the gin-house, exclusive of the cotton-sheds, is thirty by sixty feet, and the cost of putting up such a building varies so greatly, according to the cost of lumber and the skill of the farmer, that no estimate can be given. It may be said in general, however, that when a farmer commences the cultivation of cotton upon a place where there is no gin, by employing two or three of the laborers to assist a carpenter during the months of July and August, and by the expenditure of about a thousand dollars, he may push his gin-house to a sufficient degree of advancement to enable him to gin out his first crop during the fall and winter. After that he may go on enlarging and improving until he may, without extravagance, have expended from fifteen to twenty thousand dollars in appliances for preparing his crop for market. Great improvements have been made within twenty-five years in the shape, size and compactness of the cotton bag or bale. At first no presses were used, but a strong canvas or gunny bag was fastened beneath a hole in the floor of the lint-room and the cotton packed by throwing in a little at a time and pressing it down with the weight of the body, the laborer standing in the bag and gradually filling it up to the surface of the floor. A great deal of the Sea Island cotton is now packed for the market in that way.

One half, probably, of the crop of 1860 was pressed by wooden screws working in a large wooden frame-work which, on account of its size and awkward shape, looking like a gigantic letter A, could not be erected under shelter, but

stood in the yard near the gin-house. The other half of the crop was baled by an iron screw, turned by a mule, and situated beneath the lint-room in the end of the gin-house. Neither the wooden nor the iron screw reduces the bale to a proper size for exporting. On that account nearly all the crop, when it reaches the export towns, such as Galveston, New Orleans, Mobile, Savannah, and Charleston, is subject to a wasteful, expensive and unnecessary process of *compression*. The plantation bale, weighing about five hundred pounds, and measuring from sixty to eighty cubic feet, is placed beneath a very powerful steam press and reduced about one-half in size, so the average bulk of the Mobile bale is thirty-three cubic feet, and of the New Orleans bale thirty-two cubic feet, and their weight from four hundred and fifty to five hundred pounds. The East India cotton is brought to Liverpool in bales averaging a little under four hundred pounds in weight, with an average bulk of fifteen cubic feet; it thus appearing that in India the cotton is compressed to nearly half the compass of the New Orleans bale. There is no sufficient reason why this neat and solid packing should not be done at the plantation, thus saving the planter an expense of from one to two dollars a bale now incurred at the shipping ports.

Attention to this point is earnestly recommended to all embarking in cotton planting enterprises, and especially to those who have at command a sufficient amount of capital to do everything in the best manner. An outlay of from two to five hundred dollars, according to the perfection and strength of the press purchased, will enable a cotton grower to have on his premises the means of packing four hundred pounds of lint cotton in a space not exceeding a solid yard or twenty-seven cubic feet. With regard to the form of the pressing boxes, it is recommended that they be made precisely three feet each way. Thus a uniform and very neat size will be secured, and by knowing the power of the pressure employed, the number of pounds put within the space of a cubic yard will vary inconsiderably in the different bales. Good strong Kentucky hemp or gunny bagging should be used in wrapping the bales. The iron hoop is now very extensively employed instead of ropes in fastening a cotton bale, and its superiority is undeniable. It should be the aim of the cotton planter, especially of one who operates on a large scale, to send his bales from the gin-house in such a condition that they will never need to visit a compress or a pickery, but may be hoisted directly from the steamboat which takes them to his shipping port, and lowered at once into the holds of sea-going vessels. In this manner there may be an immense saving to the entire planting interest. Under the old and careless system of the past, the crop of each year was made to yield about two dollars the bale in commission, drayage, storage, compression, and numerous minor charges, by which the commission merchants of the great exporting cities became rich at the planter's expense. Instead of incurring the outlay of two dollars at New Orleans or Charleston, there is no reason why two-thirds, at least, of the entire crop should not be lodged in the holds of ships destined to Boston, New York, Liverpool, Havre and St. Petersburg, at a cost of not over one dollar incurred from the time it leaves the gin-house on the plantation. But this can never be until a superior press is in use on the plantations, and extra care is taken in the quality of the bagging, the manner of putting it on, and the width, number, and fastening of the iron hoops. It is a great advantage to have the hoops protected from the weather by a good coating of coal tar. This can be applied by any one, and the process carried on with great rapidity, in the following manner: Have a vessel of coal tar heated over a moderate fire, and let the iron hoop to be varnished lie near the fire also, so as to be warm. Encase the right hand in several folds of woollen so as to afford protection from the hot liquid. Dip the tip of the thumb and forefinger into the tar and draw the hoop through the hand, laying it aside to cool. In this way a sufficient number of hoops to bind several hundred bales can be prepared in a few hours. It is a disagreeable job, and should be done but once for the whole season. A great variety of fastenings for

iron hoops has been invented, each of which has its advocates. The Merrill tie is certainly a very good one. There is another which operates by having the ends of the hoop corrugated and a clasp made to fit, holding these corrugations face to face, one end upon the other. With a supply of rivets and an active hand the ends can be fastened by riveting as quickly as by any of the other methods, and this is a little less expensive in most cases. The large and enterprising planter requires to have knowledge and skill in three different lines in the course of the planting year. From February on to November he is little else than an agriculturist, and the same judgment which makes a good tobacco-grower or wheat-producer will enable one to plant cotton successfully. When his seed cotton has accumulated and he starts his gin to work upon it, he then needs to be something of a machinist, in order to know precisely how a gin should run, and what to do if it becomes deranged or does its work badly. Some degree of skill also is required in putting up a good, firm, compact bale, which will go to Liverpool without losing a lock or bursting a hoop.

Now follows the question of the cotton market; whether he had better sell immediately or hold on; whether the Liverpool and Manchester supply is large or small, and how much is likely to be consumed by American spindles. In order to sell, or instruct his merchant when to sell to the best advantage, the planter must be informed upon these questions. It is also very much for his profit to make his purchases of bagging, hoops, cloth, flour, salt pork, and farming tools at the markets where the best are obtained at the lowest prices. The months of December, January, and a part of February are generally taken up by the planter in inquiries and transactions of the kind just described. This is the time also for planning the work of another year, securing laborers, and repairing or erecting dwelling-houses for them.

IMPROVED AND SCIENTIFIC CULTIVATION OF COTTON.

The foregoing instructions and details have been given with the view of furnishing the most desirable and important practical aid to the tyro in cotton-growing. In his first year's planting the beginner must, to a great extent, take things as he finds them, and adopt the best method in vogue among the old cultivators; but with the beginning of his second year's experience, he may take original and thoroughly correct views of cotton-planting as one of the grandest departments of American industry, giving a proper attention to the subject in all its bearings. The first leading principle that should be impressed upon the mind of every person connected with the production of this great staple, is the *supreme importance of preserving the productive capacity of our cotton lands, and not allowing their fertility to become diminished by successive crops.* The Creator has blessed this continent by giving us a belt of country two hundred miles in width and twelve or fifteen hundred in length, where the requisite conditions for the growth of this great staple are met in a perfection that occurs nowhere else on the face of the earth. From this strip of the earth's surface a large part of the clothing of the human family for successive generations, is to be derived. The exhaustion and ruin of large portions of this area would be a loss and a disaster not to this country only, but to the entire family of mankind, and the mode of culture which has been practiced, and is still practiced, of exhausting the fertilizing salts from the soil and allowing the surface to become incapable of tillage, cannot be reprobated in terms too emphatic.

At the outset of his planting enterprise, the cotton-grower should adopt the following axioms as fundamental principles: First, *by a judicious and effective system of circle ditching and circle ploughing, to prevent his soil from washing and to retain in place all the fertilizing salts that it now contains, or that he may add in the form of manures;* second, *ascertain the amount of exhaustion that a cotton crop necessarily occasions, and scrupulously return to the soil that quantity of the fertilizing salts in manures of various kinds.*

There are three reasons why circle ditching and circle ploughing are vastly more important on our cotton soils than in any other part of the country. In the first place, all our upland cotton fields, except a few of the black lands, have a soft, loamy and friable soil, easily pulverized, and very easily washed away. Second, cotton demands very clean culture. All weeds and grass must be not only kept under but wholly destroyed; and when this is done, as it should be, there are no roots except those of the plant itself to check the action of water upon the surface. And in the third place, our cotton soils are not protected from washing away in the winter rains by frost and snow, as are those of more northern latitudes. A little reflection upon these facts must convince every cultivator of the uplands of the south, that he is bound to use special diligence to prevent washing in his fields. This would be so if those lands were fresh; but many parts of South Carolina and Georgia have been devoted to cotton culture for fifty years, and these surfaces have in that time become almost worthless, mainly from the continual and unchecked action of the rain upon them. This gashing and washing away of the surface is very extensive in all parts of the south. If one should travel across the country from Cape Hatteras to Natchez, he would pass through millions upon millions of acres which, having produced ten, fifteen or twenty successive crops of corn or cotton, have been thrown out as worthless and abandoned to sedge grass, blackberry bushes, stunted pines and foxes. A very great portion of these unimproved or worthless lands is capable of being redeemed and rendered productive by a judicious use of the circle ditch and of manures.

A circle ditch is a shallow trench with a corresponding bank of earth on its lower side, laid out upon an inclined surface in such a way that its fall or grade will be uniform throughout its length, and so moderate that rain-water will be conveyed through it without washing its bed. In reconnoitering a field with a view to marking out such a ditch, the first thing to be ascertained is the lowest point or the natural exit of the water shed. Starting from this point, the character of the soil must be taken into account with the view of ascertaining the grade necessary to prevent washing. As a rule, most of the soils of the cotton States, at least, require a descent so moderate as to fall only one inch in twelve feet, or a quarter of an inch to a yard. If the planter has a good surveyor's level, with standards graduated to feet and inches, and understands their use, he needs no further directions; but nine out of ten cannot be presumed to have such practical knowledge in the use of surveyors' instruments. A very good substitute can be made by any person at all familiar with the use of tools, in the following manner. Take a piece of board twelve feet long, four inches wide, and one thick. Screw a standard or leg upon each end of it. The standard should be about three feet high and two inches square. Let one of these legs be just one inch longer than the other. Now fasten upon the top or side of the bar a common builder's level. It is easy to see that when the bar stands perfectly horizontal—and this will be indicated by the level—the surface of the ground at one extremity will be one inch higher than the surface at the other extremity. Now start with this instrument from the spot selected for the discharge of the waters, placing the leg at this point. By moving the other end until the level indicates that the bar is horizontal, the first twelve feet of the hillside ditch will be marked. The long leg will stand at position No. 1, the short leg at position No. 2. Now set the long leg in position No. 2, and let the other extremity move over the face of the slope until the horizontal is found. Mark this position, and thus proceed, using judgment to carry the ditch in such a way as to receive the greater part of the wash of the hillside. If the slope of the hill is quite uniform, the ditch will be a series of ox-bow curves. If the slope is not so regular, the line of the ditch will show corresponding variations from regularity. When the position of the ditch is thus indicated, two or three deep furrows are ploughed, the furrows to lap down hill all the time, and the trench thus made is deepened by

the use of the hoe and spade. The ridge thus created being trampled or rolled firm, is never after to be disturbed by the plough. When this hillside is ploughed let the furrows have the same direction as the ditch, and let the cotton rows or beds be laid off in the same curve. If this is done during the summer, the cotton ridges themselves being well kept up by constant ploughing, will almost entirely prevent the hillside from washing at all; but when the crop is gathered and the fall and winter rains set in, little gullies will commence to form nearly at right angles to the direction of these rows. Such gullies would soon deepen and cut the whole face of the hill in gashes and sluices were it not for these ditches, whose firm banks arrest the downward rush of the waters and compel them to descend in a given way and with a retarded velocity. Thus a basis is laid for restoring the fertility of an abandoned field and an effectual means pointed out of preventing the devastation of fresh lands.

The cotton plant, or rather the wool of the cotton plant, removes from the soil where it is grown but a very small portion of the fertilizing salts; and hence, where washing is prevented and the seed given back to the soil as manure, cotton fields decline in fertility very slowly. This may be chemically shown by reducing the wool to an ash. Take, for instance, fresh upland soil, where the growth is magnolia, white oak, poplar, and beech. When first cleared, an acre of such land will yield a bale, that is, four hundred pounds of lint cotton. If these four hundred pounds were burned to white ash, the residuum would be about four pounds of mineral substance, of which about one-third, or one and one-third pounds, is potassa; one-sixth, or two-thirds of a pound, is lime; and one-eighth, or a half pound, is phosphoric acid. There is also a little magnesia and sulphuric acid. Now, if no portion of the plant is removed, but left to decay on the soil, and the seed (which is necessarily taken away with the lint) is returned from the gin-house, as it may be, and scattered upon the surface, it is plain that you only need to restore to this virgin soil something over a pound of potash, two-thirds of a pound of lime, and half a pound of phosphoric acid to keep its fertility undiminished. If *one bushel* of compost were made by crushing a peck of bones, adding a little sulphuric acid, a peck of gypsum and a half bushel of ashes, and this mixture be sprinkled over the acre, the restoration of fertilizing salts would be equivalent to the exhaustion occasioned by the harvesting of two or three successive crops of cotton of a bale to the acre. But an immense difference would appear if the seed were never returned, for with every four hundred pounds of lint there grow twelve hundred pounds, at least, of seed. If this twelve hundred pounds of seed were burned, it would yield nearly fifty pounds of white ash, of which nearly two-thirds, or thirty pounds, would be phosphate of lime, and fifteen pounds phosphate of potassa—fertilizing salts which are most important to vegetation, and which are especially consumed in the production of the most valuable of all our vegetables, such as the cereals and cotton. It thus becomes clear that the removal of the cotton seed takes from the soil from twenty to thirty times as much fertilizing matter as the removal of the lint only; or, in other words, and to give the last practical result, the planter who takes from his cotton field only the wool, diminishes its fertility very slowly; whereas he who takes the seed with the wool and makes no restoration, is exhausting his fields as rapidly as he would by successive crops of corn, wheat, or oats. Another practical conclusion follows from these premises. If the cotton-grower inquires what manures he should employ in order to keep up the fertility of his fields, the answer is any manure that is rich in potash and phosphate of lime, such as gypsum, crushed bones, guano, barnyard manure, and particularly the droppings of all the animals that are fed on strong food, such as corn, oats, clover, and cotton-seed.

Great improvements are also possible in the ease and rapidity with which a crop is cultivated. There is no reason, in the nature of things, why cotton should not be planted and cultivated in very much the same manner as corn is culti-

vated in Illinois. The hoe has been far too much relied upon as the implement for the cotton field. Now the hoe is the rudest, the least effective, and the most exhaustive to strength and patience of any tool largely used in our fields. On all level lands the following method of culture would be a decided improvement on that now in vogue. Apply manure in March, and immediately after cover it by one deep, thorough ploughing. At planting time harrow the field, and then, with a marker, lay off the land in rows and cross rows, say four feet one way by three the other. Let the seed be well selected from large perfect bolls which ripened early. Just before planting soak it for a day or two, and roll it in a mixture of gypsum, ashes, and guano. Let the seed-dropper follow immediately after the marker, depositing five or six seeds in the little pit produced at the crossing of the rows. In this manner a perfect stand may be obtained of thrifty plants, at regular intervals, so that by running the ploughs each way the first cultivation may be performed very rapidly, and nearly all the subsequent labor can be done with the plough rather than the hoe. This method of cotton planting has been long and successfully practiced by Dr. Cloud, of Alabama, and is earnestly recommended in his writings on cotton culture. Another important improvement greatly needed in the southern cotton fields, and which will now be introduced to an extent never practiced before, is a judicious rotation of crops. The practice of keeping the uplands of the cotton region constantly under the plough, with no variation in the crop, except the change from corn to cotton and from cotton to corn again, has been earnestly deprecated by all the best writers on southern agriculture, and by none more earnestly than by Dr. Cloud, who, from his long-established and highly successful system of culture, has demonstrated its great importance.

Another radical modification of the former system, which ought to be made immediately, and which would give to cotton-growing an impetus which it could derive from no other source, is the building of neighborhood gin-houses in well-chosen locations, so as to be central to large farming communities. These mills should be propelled by steam, and furnished with the best of apparatus for ginning and baling cotton, and also for extracting oil from cotton seed. The existence of such a mill within the distance of five miles would be a strong inducement to the small farmer and the poor immigrant, from the northern States or from Europe, to engage at once in the planting of cotton. Under the present system it requires considerable capital to justify one in embarking in a planting enterprise, a large part of which is absorbed in the purchase of a gin, the construction of machinery to run it, and the erection of a gin-house, or in the high price of a cotton farm if it has all these improvements. In the future the uplands of the south are destined to be cultivated to a very great extent by persons in modest circumstances, who will till farms of from twenty to eighty acres in extent. Nine-tenths of this class of cultivators will never become the owners of a well-appointed gin-house, and the practical difficulty will be in not having the means of preparing their cotton for distant markets at the right time and in the best manner. There is no southern enterprise in which capital could be invested with greater safety, or with more certainty of sure returns, than in building such mills at well-selected points. They should be equipped with the best arrangements for ginning, a press sufficiently powerful to put four hundred pounds of best cotton within a space of a cubic yard, and a mill and other apparatus for the production of cotton-seed oil. There should be, in addition, the spindles and looms necessary for the production of forty or fifty thousand yards annually of the coarser fabrics.

What would now be the practical bearing of such establishments, located at proper intervals through the great cotton regions of the south? In the first place, the large land-owners, whose fortunes now consist in surfaces not more than one-tenth of which they are able to cultivate, would find an immediate and increasing demand for tracts of from forty to eighty acres in extent, which would

be settled upon and cultivated by poor but industrious people. These settlers or immigrants would require no investment beyond the price of a few mules and a few ploughs, for they would expect to take their cotton in the seed to the mill, and there find a market for it. In many cases they would be only too glad to exchange raw cotton in the seed for a sufficient amount of plain muslins and linseys to clothe their families. The value of the oil expressed from the seed would be sufficient to pay the mill-owner for ginning, and thus justify him in giving the small cotton-grower as much for his unginned cotton as he could get for ginned cotton in New Orleans, Mobile, or Charleston.

The various hands employed about such a mill could thus find steady employment for six or eight months of the year, and during the picking season they could make excellent wages working in the fields at so much a pound, or for a fractional share of the amount picked, while such a supply of labor from the mills would warrant the farmer in planting a third more cotton than he would if no such extra help were possible.

This plan is earnestly recommended to all capitalists who are desirous of making such investments of their money as will secure the most general prosperity, heal the breaches and repair the damages of the civil war, and thus exhibit the highest political wisdom by a practical solution of the labor problem in the south, and insure the greatest good of the largest number of people.

IMPROVEMENTS IN COTTON SEED.

The most serious difficulty encountered by cotton-growers, and particularly those who are engaging in such enterprises for the first time since the war, has been found to be *poor seed*. This is attributable to two reasons. First, cotton seed loses its germinating power unless carefully withheld from moisture, and kept cool; and, second, for seven years little or no pains have been taken by any cotton-growers to perfect their seed.

After passing through the gin the seeds of the cotton still have a little fine lint attached to them. This causes them to cling together, and mat down in such a way that the air is excluded. For this reason special pains should be taken with seed intended for planting. The seed should be spread upon a loose scaffold, so as to allow free access of air, and be frequently stirred, so that none may be spoiled by fermentation.

Cotton seed may be perfected by the same care that is bestowed upon corn and potatoes; and where a planter aspires to success in his business and high position as a southern agriculturist, nothing is more directly in his line, or pays better for the time it occupies, than the development of the most perfect plants, as regards both the amount and quality of staple produced. By what steps or methods of culture can the cotton-grower develop superior qualities in his seed cotton? By way of introduction to a few practical suggestions, in answer to this question, let it be borne in mind that the superiority of one variety of cotton seed over another may be either in the fineness of staple which the plant yields, or in the number of bolls developed on each plant. Some varieties excel in quality, others in quantity. The planter should bear in mind that, as stated in the early part of this paper, some kinds of manure tend to produce size, and others spend their force mainly upon the seeds, and through the seed upon the length and fineness of the staple. It is recommended to the cotton-grower to select a field having a southern exposure and a moderate slope, at a short distance from his barn, for the planting of that part of his crop to which he looks for his seed cotton. Suppose the land to be good, and that he has ten acres in his field, let him put upon it the greater part of his barnyard manure, and, in addition, some of the concentrated fertilizers, such as lime, bone-dust, guano, ashes, and gypsum. He may vary the application of his manures, so that one part of the field will be particularly rich in potassa, and the other in phosphate

of lime. The planting and cultivation should be done in the best manner. Early in September the bolls will be open, so as to enable him to commence picking. This should be done by a skillful hand, and this he will generally find in some old person, who has had many years' experience in the cotton field. Let the picker have two bags, into one of which he puts bolls from the thriftiest and most prolific plants, and into the other such bolls as are large and well developed, and remarkable for the softness and length of the fibre. In this way he will obtain two classes of improved seeds, one likely to produce very largely, and the other likely to yield a superior staple. On the year following, let him use discretion in planting these two varieties, which, for distinction's sake, we will suppose he calls by different names, marking one "silk cotton" and the other "multiboll." His "multiboll" should be planted on his freshest soils, and such as abound in potassa; and his "silk cotton" on the older lands, which, for the purpose of producing a fine quality, should receive a top dressing of bone-dust or guano. Let him also, as before, choose ten acres for the raising of his seed cotton, planting one-half of it in "silk" and the other half in "multiboll." In this way he will soon be known as the producer of two superior qualities of seed cotton, and find such a demand for his seed, that it will be worth five dollars a bushel, so that each acre may yield him a greater return in cotton seed than in lint. This would, with certainty, be the reward of his painstaking, unless most planters, by similar painstaking, produce greatly improved varieties; but supposing no seed were sold, the difference between improved and unimproved seed is very great, sufficient to justify the most thorough painstaking on the part of the planter. The various new and improved varieties of cotton seed which, from time to time, have enjoyed a brief but lucrative popularity, such as the "Brown," the "Banana," the "Cluster," the "Hogan," the "Sugar Loaf," "Boyd's Prolific," and "Hundred Seed," were developed from the ordinary Mexican, or "Petit Gulf," in precisely the manner above described. For some time the "Mastodon" seed commanded five dollars a bushel. "The Hundred" seed, a superior variety developed by Colonel Vick, of Vicksburg, from the "Petit Gulf," sold, year after year, at two dollars a bushel; and the "Banana" had such a wonderful reputation fifteen years ago that the seeds were sold at a dime each, or one hundred and fifty dollars a bushel!

It need hardly be suggested to an intelligent planter that any seed which he may develop by painstaking, or purchase at a high price, will deteriorate in two or three years by neglect and careless culture; on the other hand, by taking the steps above detailed, he may improve any seed so as to double or treble its value. A variety of cotton that opens early may be obtained by gathering, from year to year, all the seed cotton in the early part of September. In like manner the famous "Prolific" cotton originated from a single stalk, which was selected, and its seeds carefully preserved, by a Mississippi planter, who observed it in passing through his fields. A year or two of careful experimenting will teach the planter which variety is best for a particular description of soil; some doing best on soils of moderate fertility, and others requiring rich bottoms. If he purchase but a single bushel of any variety known to be superior, this will plant two acres. These two acres will yield him, at least, six hundred pounds each, or twelve hundred pounds of carefully selected seed. These twelve hundred pounds will be sufficient to plant eighty acres. Thus, at a very small expense, and with moderate care, he may soon be in possession of the best quality of cotton seed; and the difference between the inferior grades and the first quality of seeds is, practically, in many cases, the difference between harvesting four hundred pounds of cotton from an acre, and the harvesting of two hundred pounds from the same area, and with the same amount of labor. On the other hand, if the planter's ambition has taken a somewhat different direction, and he prefers quality to quantity, proper care will enable him, in a few years, to produce a staple which, for softness and fineness, approaches the Sea Island cotton, and for manufacturing

purposes would be worth twice as much per pound as good middling upland. It should be stated, however, by way of qualification, that the great improvements in cotton and cotton seed are not to be obtained, even by the utmost painstaking, in all parts of the cotton belt. The country between 32° and 34° north latitude has always produced the best varieties of upland. In the Mississippi valley, the region a little north and east of Vicksburg, has been famous for its improved varieties. The widely known "Petit Gulf" originated a few miles below Vicksburg. It is worthy of remark, also, that very little has ever been gained by importing foreign seeds, such as "Nankin," or the Egyptian and West Indian varieties. Cotton from any part of the world, in a few years, adjusts itself to the zone and soil where it is constantly planted; and, as a general rule, the cotton-grower will accomplish more by scientific cultivation of the seed he has, developing the best for his lands, than by spending time and money in the introduction of famous but untried varieties.

AIDS TO CATTLE FEEDING.

BY L. S. ABBOTT, PAINESVILLE, OHIO.

THE TURNIP.

The turnip is a useful vegetable, and becomes the subject of interesting inquiry from two facts: that it is an esculent for the table, and an excellent article for feeding stock. For the table it is not so valuable on account of its nutritive as for its gustable qualities. It becomes desirable, however, by increasing the number of esculent roots for the table. The carrot, it is true, is more nutritious for stock, but it is not half so easily grown nor half so sure a crop as the turnip; and while the carrot is not so generally relished on the table, there are, in comparison, few palates that do not find the turnip agreeable. Moreover, the experienced agriculturist must confess that the turnip is the cheapest and the easiest grown of all the roots.

VARIETIES.

Men now living, who were obtaining their agricultural experience fifty years ago, say that they then knew of but two varieties of the turnip, the Flat Dutch, and one other. Now there are one hundred varieties, more or less, in existence, of American, English, French, and Swedish origin; but of all these the cultivated varieties are reduced to a very small number. A Philadelphia seedman imported fifty-two varieties, and yet he offers to the public for sale the seeds of less than a dozen; and a dozen varieties comprise nearly all in general cultivation. It is quite sufficient for the purposes of this article to confine it to a practical consideration of the subject, and hence to introduce only those sorts desirable for cultivation.

In the northern States, for a half century or more, the Flat Dutch has been grown. Tradition and superstition have enjoined upon the agriculturist to sow it, without fail, on "the 24th day of July, wet or dry." This turnip, although it has been cultivated so long and so extensively, is really an inferior article. Its quality is passable only under the most favorable circumstances. It cannot be relied on in a timber country unless grown on new soil, as where a piece of new ground is cleared, the brush burned off, and the seed raked in. It grows, also,

in its greatest perfection on the sod of the western prairies. But good as this variety may be when fresh, it does not keep well, wilting and becoming pithy. For the table they are quite indifferent.

Two strap-leaved varieties are much grown in the middle States, and the most northern of the southern States, and to some extent still further north. The difference in these two varieties is more in the color than the quality, one of them being white and the other yellow. The white one, from its resemblance to the Flat Dutch, would be readily confounded with it by the casual observer. They are of better quality, and yet they are decidedly inferior to some other varieties.

But there are three varieties better than all the rest, an account of which will serve the ends of this article. Of these I first notice the third one as regards quality—the old ruta-baga. This root, when grown under favorable circumstances, is good, but is as variable as the Flat Dutch; and when the soil and season are unsuited to its growth, the root is tough, stringy, strong in flavor, and unpalatable, and too often is perforated by worms. It is certainly an uncertain grower, and the horticulturist and the husbandman are more likely to get a poor article than a good one.

The *White Norfolk* is a better grower, and the producer is much more sure of a crop and of quality of root than with the former. It should be more generally cultivated, especially when an increase of varieties is desired.

But incomparably the best turnip in my opinion, is the "Russian," or "Sweet Turnip." It seems to combine all the good qualities of the turnip family, and certainly has no peer among the varities that have been introduced among the people. Being the *sine qua non* of its kind, it will require a more extended notice than has been given to those mentioned above.

It has a sweet flavor, as its name indicates, is crisp, has more substance than any other variety, and as an esculent root, is very relishable. The grower of it never need fail of a crop, either in quantity or in quality, unless the season is unusually bad. With a rich soil and good cultivation the sweet turnip will never be pithy, wormy, tough, stringy, or have any acrid, pungent flavor, as is too often the case with most of the other members of the family.

Theories have been indulged in by various writers, whose opinions or statements could not have been based upon actual experiences. They assert that the large leaves of the turnip draw from the atmosphere a large portion of its support, and that, therefore, condition of soil is of secondary importance. This theory must be the offspring of the thought that, as the root is composed more largely of water than nutritious substance, its support must be derived from the humidity of the air. There is one other fact which goes to sustain this atmospheric theory: a moist soil is not requisite to grow the turnip most successfully. The largest Russia turnips I have ever produced were grown on sandy sweet potato ridges, where the potato plants had died out. Undoubtedly every plant receives some nourishment from the air, but experience demonstrates the fact that a rich, productive soil and good care are needed to grow good turnips in abundance.

For transplanting, the seeds should be sown from the 15th of June to the 25th of the same month, and the ground selected for the purpose should be new ground, near the barn, or some corner of the garden, or in the fields where the patch will be protected, the bed of a brush heap being a desirable place, or some retired spot where the soil has been resting. Turnip and cabbage plants have, as enemies, when young, many destructive insects, and such places as are here indicated are comparatively exempt from their presence. The plants will be ready for transplanting about the middle of July.

WHERE TO GROW TURNIPS.

The villager will find that his early onions, early potatoes, and his peas will come off in time for transplanting his turnips. Spade up well after in-

corporating thoroughly some well-rotted manure, and set the plants about fifteen inches from each other in the row, and place the rows about thirty inches apart, puddling the plants well when they are set; and be the weather wet or dry, hot or cool, clear or cloudy, they are sure to grow. The farmer, however, growing for feeding stock, as every one should, will from necessity take a different course. His crop of early potatoes will be taken off in time for turnips. When sown to grow without transplanting, the seed may be put in from ten days to two weeks later than when sown for transplanting. The early potatoes should be dug and taken to market as early as possible for profit. Put a drag on to level off the ground, clear away the vines to allow the small plow to strike a furrow for the row, and locate the rows far enough apart to admit the cultivator; drive in the wagon loaded with manure, and scatter in the furrows. Turn a light furrow on the manure, sow the seed, and cover lightly with a hoe.

EFFECTS OF TRANSPLANTING.

Transplanting has a peculiar effect on the form of the turnip. An experienced eye can determine whether the turnip has been transplanted, or sown where it grew to maturity. Transplanted plants always produce turnips of irregular shape, with sundry large roots running down into the ground; those not transplanted have a round, smooth bulb, with a single tap root extending into the earth.

SIZE FROM DIFFERENT SOWINGS.

I am able, under this head, to give, from data, the results of the different sowings stated: Turnips transplanted from seed, sown at the proper time in June, grew, under favorable circumstances, very large, some of them so large that but one could be put into a peck measure. Seed sown in drills the first of August, in an ordinary season, grew from three and a half to four inches in diameter, crisp, sweet, and of most excellent quality. Seed sown about the 10th of same month, produced turnips only one and a half inches in diameter, while from those sown the 15th the turnips were not an inch in diameter. The later sowings, however, were not as well cared for as the first, which fact should be noted.

KEEPING QUALITY OF THE RUSSIAN TURNIP.

The keeping quality of the Russian turnip is all that can be desired. There is no difficulty in keeping them for the table or for stock, into July, sound, crisp, and as finely flavored as they ever were. Hence, in this root we have quality, certainty and rapidity of growth, and productive results incomparably above any other known variety; we have in this turnip, in a word, the very acme of excellence.

FODDER.

Custom has much to do with keeping quite general the practice of depending upon the grasses, cured and made into hay for provender or fodder, during the winter and stock-feeding months of the year. For transportation, hay will probably be depended on as rough feed for stock, since it admits of compression to a greater degree than any other coarse feed yet produced. It requires no wonderful stretch of the imagination, however, to look forward to a period when our broad, unpopulated domain shall be so thickly inhabited as to require the adoption of some article for feeding stock that will yield a greater amount of more nutritious food to the acre than the ordinary grasses, and it would be wise to search out and adopt at once such an article, as more profitable for the farmer. On this fact, then, I base this plea for sowed corn for stock feeding. Sowed

corn may be resorted to with almost certain success to repair a short grass crop. The 1st of June will generally determine whether the grass crop is to be short, or an entire failure, after which there is time enough to sow corn and make up the deficiency.

QUANTITY AND QUALITY.

The quantity of fodder that can be grown on an acre of ground is very large. I do not know that the amount has been accurately determined by weighing, but good judges have placed the product at ten tons, whilst in quality it is very much better than hay, besides stock of all kinds relish it far more. For milch cows it is almost invaluable. Let any farmer change his bright, well-cured corn fodder, which he has been feeding his cows, for hay, no matter how good the quality, and he will find in forty-eight hours that his cows will have decreased the quantity of their milk from one quarter to one third.

TIME FOR SOWING, WITH RESULTS.

After planting is over there is time for sowing corn, and have it come to fit condition for cutting in good weather to cure well and rapidly. Sow broadcast, if the greatest yield possible is desired. Some sow in drills, with rows wide enough apart to admit the cultivator, but this is not wise since the stalks are too coarse to be entirely eaten up by stock. But the sowing may take place at a much later time, and realize a very satisfactory growth. Sown as late as the middle of August, even in a summer drought, the corn will ordinarily tassel before the autumnal frosts in the latitude of Northern Ohio. The amount of seed required for broadcast sowing is about three and a half bushels for an acre.

But for one drawback the corn might be sown any time during the first half of the summer months, with satisfactory results, and that is the difficulty in curing the fodder late in the fall, when usually there is much bad, rainy weather. The stalks are so full of saccharine juice that they require several consecutive days of summer-drying weather to cure.

HOW TO CUT AND TO CURE.

When the farmer makes sowed corn the chief reliance for his fodder he will be wise enough to sow in good season, so that there will be no weather contingency at curing time. The cutting time brings the labor of this crop. As above indicated, this should be done early that good weather may attend the remaining operations. When the corn is "stout" the burden on the ground is very large, and when the season has been attended with heavy wind storms the corn will be twirled or twisted around, and sometimes badly. Just in proportion as this is the case will the cutting be laborious. There is a "cradle" made for the purpose, with short, strong "fingers," which does the work expeditiously when the corn stands up. Five or six days of warm, bright weather, are required to wilt it sufficiently to admit of binding. The bundles should be small and put up in moderate-sized shocks, and tied at the top to keep them in place.

Another method of curing, commended by some farmers of experience, is to wilt the fodder well, then stack it with alternate layers of straw, first elevating the foundation by crossing timbers for the same, to give circulation of air underneath, and then stack around a box, drawing it up as the stack is carried up, as is done in the West when wheat cut by "headers" is stacked.

In the South, where the autumns are bright and beautiful, the air warm and drying, and the soft temperature and mellow tints of the autumnal season are drawn out far into the winter solstice, this kind of food for stock should be the main dependence of the planter. Corn grows well as far south as Texas, whilst

hay-making grasses are not grown in that region, so that fodder may be his never-failing resort.

Horses fed on good corn fodder never will be seized with that relentless disease, the heaves. Cattle fed on it, and then messed with some sweet turnips, cannot be fed better, will have sleek hair, bright eyes—in fine, to employ the farmer's common and comprehensive phrase, will always "be in good heart."

INDIAN CORN CULTURE.

BY J. F. WOLFINGER, OF MILTON, PENNSYLVANIA.

SOIL.

The best soils for the growth of Indian corn are such as contain a deep, rich, warm, mellow, and porous ground, fully permeable to the air, heat, and moisture. In such soils the growing corn can extend its roots freely both in depth and sideways, as corn must do to yield large and fine crops; and as our river bottoms and sandy and loamy grounds possess these properties in the highest degree, they are everywhere regarded as our best corn soils. The lowlands or bottoms usually produce the largest stalks and ears, and the uplands or higher grounds have the heaviest grains. Corn planted upon stiff clays and hard, gravelly grounds is very likely to prove poor or a total failure, because such soils are so tough and compact as to exclude the air, heat, and moisture, and hence are destitute of the necessary porousness and warmth. Corn is, indeed, a very hardy plant, and will grow almost anywhere, but it will yield profitable crops only on soils that are deep, rich, mellow, and warm, and no man, as a general rule, need expect to raise such crops on any other soil.

PREPARATION OF SOIL.

If the ground intended for growing Indian corn is covered with clover or grass, it is mostly ploughed *but once*, early in the spring, or just before planting time, if the soil is naturally a loose and mellow one; but if the soil is hard and tough it is customary to plough the ground *twice*, once in the summer, or fall, or winter, if possible, and just deep enough to cover the sod properly, say from three to five inches deep, as that depth will hasten the decomposition of the clover or grass more rapidly than deeper ploughing, and then *cross-plough* the whole again in the ensuing spring as deeply as desired. Late fall or winter ploughing of grass and clover grounds for corn has many advantages to recommend it; it exposes the cut-worm, heart-worm, and wire-worm, in their embryo state, to the action of the frosts, and thus destroys them; the grass or clover then ploughed down becomes rotten so much earlier than it would under spring ploughing, that it enriches the soil and makes it mellow, and so more easily tillable in the ensuing spring, while at the same time it greatly increases its moisture and productive power, and so secures a good crop of corn in times of severe summer drought. Early spring ploughing, as soon as the frost leaves the ground, is also useful on an over-loose or a too porous soil, as the early rains will then settle and pack the ground previous to planting, and so give the corn a better chance to take root and grow up rapidly than it would otherwise have. But the grass or clover, at

whatever season ploughed, should be turned over into the ground as thoroughly and as smoothly as possible to prevent new shoots from growing out of their roots. If the ground intended for corn be a *stubble or fallow* ground it is usually ploughed but once, but not until the ground is warm, and just before corn-planting time. Some plough such grounds twice or thrice if the soil is very hard and tough.

The depth at which corn ground is ploughed varies according to the nature of the soil and the cultivator's views, and ranges from three or four to twelve or fourteen inches. Deep ploughing is evidently on the increase, and very properly so upon old and exhausted soils. If the ground is naturally too low and wet for corn, it ought to have its furrows thrown up against each other in the form of ridges, that its ridges or elevated parts may dry out the more readily, and so be rendered dry enough for the reception of the corn seed. But if the ground has no moisture to spare, the furrows should be ploughed as level or flat as possible, as this will make the soil retain its moisture better, and also render it more productive.

The ploughed ground should be thoroughly harrowed lengthwise of the furrows, and made smooth and fine, but never so deep as to tear up or disturb the grass or clover sod ploughed down. If the ground, however, is lumpy or cloddy, or too loose and porous to retain moisture, or you wish to pursue the flat or drill system of corn planting, you should pass a heavy roller over it when the ground is dry, before commencing to harrow it. Ground so ploughed up in the fall or winter may be rolled, but ought not to be harrowed until the ensuing spring; and in all cases, after harrowing, the ground should be nicely furrowed out at the proper distances for corn planting, and just before corn-planting time, so that the soil may be full of air and moisture when your seed is planted, to insure its speedy germination and growth.

SELECTION AND PREPARATION OF SEED.

The best way of selecting seed corn is to go into the best field of ripened corn and gather the largest and best ears on those stalks that bear the largest number of finely developed ears, and store them away in some dry and airy place, as the grains of such ears generally produce similar stalks and a like number of ears. As the same variety of corn will, like the other cereal grains, deteriorate if grown for a series of years upon the same ground, or on soils of a like character, it will be advisable to *change the seed* by procuring some new and hardy variety of corn as soon as the old seed becomes less productive. In procuring new seed it is always desirable to obtain the best kinds of our more northern climes, as they ripen early, and acquire increased vigor and productiveness when grown in a warmer and more congenial climate, while seed obtained from more southern latitudes will not only ripen later, but require many successive plantings before they will suit and yield well in colder regions. Those grains of corn only should be planted that grow upon the middle or central portions of the cobs, as those on the butt ends of the cob are not so good, and those on their tip ends are poorest of all. Seed corn is prepared in various ways for protection from cut-worms, grub-worms, crows and other birds, squirrels, moles, and mice. It may be soaked in pure water, either hot or cold, containing pretty strong solutions of salt, saltpetre, sal ammoniac, tar, coal tar, or copperas, and then rolled in finely ground plaster or air-slacked lime until dry enough for planting. Tar, coal tar, salt, and saltpetre are offensive to and will effectually protect the seed and sprouting corn from the ravages of worms, grubs, crows, and other birds, squirrels and mice, while the lime and plaster not only hasten the vegetation and growth of the crop, but impart to it a rich green color. The seed so prepared should be planted immediately after it has undergone this protective preparation, since too much drying of the seed might injure it.

TIME AND DEPTH OF PLANTING CORN, ETC.

The time of planting corn varies, of course, according to climate or temperature. Thus the time of planting in our southern States ranges from the 1st of February to the middle of April, while in our northern and middle States it ranges from the 15th of April to the 10th of June. Poor and low ground, being stiff and cold, ought to be planted the earliest and requires careful attention in weeding and cultivating while the plants are young and tender. But deep, rich and warm soils ought not be planted in our middle States until some time in May, after the ground has become warm, as the plants in such a soil will then grow right on and escape being chilled, discolored, and stunted in their growth by cold and wet spells of weather. The depth at which corn should be planted necessarily varies from one to six inches, according to the nature of the soil, for it ought on every soil to be planted just deep enough, whatever that depth may be, to keep the seed moist and insure its germination and prevent the growing plant from shrivelling or drying up. A deep covering of the seed will prevent it from rotting if planted early and the ground should continue wet and cold, while in a very dry season the seed will sprout and grow the better for it, as it will have more moisture than if planted shallow. The cut-worm also in such cases will not go deep enough into the soil to reach and destroy the heart of the seed, and hence all the injury it can do *above* the seed will not be so serious as if it reached the heart or bud itself.

J. H. Ewbank, of Macon county, Tennessee, thinks it best to put *five* grains of corn in each hill or place, as by so doing you will be sure to have a good stand, viz:

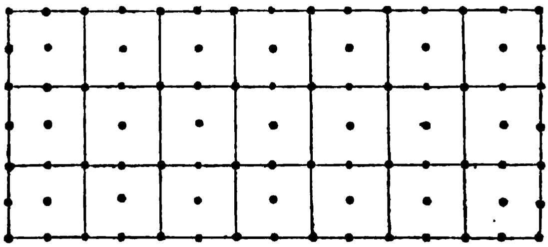
> "One for the blackbird, one for the crow,
> One for the cut-worm, and *two left to grow.*"

Three good plants in each hill are enough, especially of our largest kinds of corn, after the birds, squirrels, worms, and mice have taken away or pulled up all they can get, and if they have left more than this you should thin out the smallest and weakest and leave the strongest and richest green-colored stalks. The distances between corn hills must necessarily vary according to the richness of the soil and the variety of corn planted, since some plants grow much taller and thicker and so require more room than others. These distances generally range from two to five feet from centre to centre of each hill or row, strong and rich soils bearing closer planting than poor and thin soils, as they contain more of the elements necessary to produce strong and heavy stalks. Rows three feet apart each way, or still less, leaving just room enough for a light plough or cultivator to pass between the rows, seem to be, as a general rule, the most profitable distances for corn-planting. One great advantage in planting corn close is that it will soon become so thick or dense as to shade the ground and thereby prevent the growth of weeds and grass and retain the moisture that is in the soil and thus protect itself in a good measure against drought. But close planting requires careful cultivation and a very rich and strong soil.

Furrows and cross furrows for corn-planting should always be made as straight as possible throughout the whole field, so as to cross each other at right angles at every intersection. The ground should always be furrowed out so as to make the rows of growing corn run north and south, as that will expose each row fully to the heat of the sun, a matter too much neglected by farmers. A great deal of labor expended in furrowing ground for corn might be saved by adopting the plan of Mordecai Larkin, of Pennsylvania, who says:

"For several years past I have endeavored to discover some way to shun the ordinary tedious mode of furrowing off ground for corn, which, with us, consists in making with the plough a furrow each way of the field for each row of corn in order to save the use of the hoe in cultivation. Failing to invent an imple-

ment capable of making two or more furrows correctly at once, I changed the direction of my pursuit and was agreeably surprised in finding out the fact that we had been *making twice as many furrows as were needed.* Although this may appear paradoxical, I proceed to describe my improvement. Whatever distance apart I desire to plant I mark out *double* that space each way of the field: thus, suppose I desire to plant four by four feet, I furrow off *eight by eight feet at right angles,* and the field is then ready to plant. I then plant at the intersections, *half way between the intersections, and in the centre of each square,* as shown below, the lines representing the furrows and the dots the hills of corn.



The *unmarked* rows, which run at right angles with the direction of planting, need the greatest care of any to keep them straight. One-fourth of the hills are planted on the *surface* of the ground, but no difference is perceivable in the growth of the corn. I have planted two crops in this way, and never had the rows more regular. It appears to possess other advantages besides saving half the labor of marking. The ground is less liable to wash by heavy rains prior to cultivation. It shuns about one-half the balks usually made by the plough in the old way. It causes no fatigue to the eye or the mind to divide the spaces in dropping seed. A person having the phrenological organs of *form and size* small might not be able to drop correctly. Of this I cannot say. I estimate it to be worth at least eighty cents per acre to furrow off corn ground in the ordinary way. A farmer who adopts this plan in marking off ten acres will save about four dollars' worth of labor or forty cents per acre. From the best means I have of judging there are about nineteen millions of acres planted yearly in the United States, and if the above mode were adopted it would save seven million six hundred thousand dollars' worth of labor annually. Some allowance should be made, however, for that corn which is planted in drills.—(*United States Agricultural Report of* 1851, *pages* 257–'8.)

AFTER-CULTURE OF CORN.

The after-culture of the growing corn plants varies also according to the soil and the season as well as the attentive skill and implements used by the grower. Some use nothing but the *hoe,* especially in small patches, and hoe it from two to four times, as weeds or drought require. Others use nothing but the *plough,* and plough the ground around their corn plants from two to five times, and do it crosswise or both ways if the crop admits of it, as it should. Others again use nothing but the *cultivator,* and cultivate it from two to five times, and also both ways. Some, after ploughing or cultivating the crop, use the hoe in dressing it up nicely. Some also, if the ground is lumpy or cloddy, pass a roller over it immediately after planting or as soon as the plants are up, while others as soon as the corn is up run a light iron-toothed harrow close alongside the corn rows each way to make the surface ground smooth, fine and mellow before ploughing, cultivating or hoeing.

The first culture or stirring of the crop after it is fairly up should be deep, and every additional stirring shallower as the corn plants increase in size and extend

their roots. Some reverse this plan, and very unwisely, as they are likely by doing so to cut off or wound the roots of the corn and so injure its growth. If your corn ground is too wet you should work it so as to throw it up to and against your corn in the form of a ridge, as that will enable it to dry out the sooner and get rid of its excessive moisture. But if your ground is inclined to become too dry you should work it so as to keep the surface as level as possible, thus enabling it to retain its moisture.

The whole art of raising fine corn, after your ground is properly manured and prepared, consists in keeping the growing crop free from weeds and the ground mellow around its roots, not only while it is young and tender, but until it shades the ground well and its blossoms appear. To do this rightly, rollers, harrows, hoes, ploughs and cultivators must be used freely as the surface of the ground and the nature of the season may require. But in all of these operations great care should always be taken not to tear up or disturb any of the roots of the corn or any grass or clover ploughed down as a manure. Hence you should never work your corn ground when it is wet, as ground worked at such a time is very apt to dry into a kind of cake or paste and so injure your corn. It should be worked freely and thoroughly when the ground is dry, especially when very dry, as that will loosen up and thereby enable the soil to absorb and retain the dews of the night and the moisture of the air the more readily, and so refresh and reinvigorate the parched and drooping corn plants, an experiment often tried and with invariable success in times of great summer drought. Corn, in fact, requires more labor and attention from the time it is six inches high until it is in its tassel state than any other farm crop raised in our middle and northern States, and it so happens, providentially, that this work can mostly be done at times when but little other work is pressing upon the farmer. If good rich land requires so much care, labor and judgment to produce a fine crop of corn, then to raise good corn on *poor* lands must require far greater care and labor, and no one need expect remunerating corn crops without them. No man ever made himself rich by raising corn on poor land, and the attempt to do so will, if persevered in, only make the poor man poorer. He can, however, make money by raising corn on even such lands if he manures them well and cultivates his crops aright. A heavy crop taken off a well-cultivated soil is not so exhausting as a light crop taken from a soil only half cultivated, while good or first-rate cultivation will always pay the best, and is really not much more expensive than poor or indifferent culture.

Some plant pumpkins in every third, fourth, or fifth row of their corn, and about thirty feet apart along the rows, and so raise pumpkins without any extra labor, while the corn is supposed to sustain no injury from it, but rather to be benefitted in dry seasons. Pumpkins are a good food for cattle and hogs, and can be kept a long time if carefully gathered when dry and packed away, before the heavy frosts come, in layers of wheat or oat straw, so as not to touch each other.

MANURING CORN.

The best way of manuring corn ground is to cover it with a good coat of stable or barnyard manure and plough it down, and then top-dress it with another coat of the same or a different kind of manure and harrow it in well before planting the corn. But a strong and rich clover lea or grass sod, the heavier the better, well top-dressed with strong and coarse stable or barnyard dung and ploughed under, is, perhaps, the best and most easily obtainable food for a corn crop. Corn is a very gross and rapid eater and grower, and there is but little danger of making the ground too rich for it, even on a naturally rich and mellow soil, as strong manuring and thorough tillage are necessary to secure an extra yield of superior corn.

Manuring corn *in the hill*, either when planted or when the plants are a few

inches high, takes less manure and does nearly, if not quite, as well as a broadcast, top-dressing manure scattered all over the ground. Experience has shown that a small quantity of manure put into each hill with the seed is of great benefit, as it makes the corn germinate and grow up rapidly and strong and get an early start; and after it is about a foot high it will, if planted on a grass or clover lea, push its stalks ahead with great vigor, if the weeds and grass are kept down.

The following substances are generally used as top-dressings and hill manuring for corn crops, to wit:

1. *Stable and barnyard dung.*—Stable and barnyard manure, applied at the rate of a whole or half shovelful to each hill of corn.

2. *Hog dung.*—The same quantity of pure or unmixed hog dung, applied in like manner. Hog dung is one of the very best manures for corn, One of the best fields of corn I ever saw was manured entirely with hog dung. Cornfields hogged down, or allowed, when ripe, to be overrun with hogs, who eat the corn or nubbins, not only fatten the hogs, but are rendered rich for a wheat crop. This is a common practice among the farmers of our western States, but it is a slovenly and wasteful way of manuring land.

3. *Lime.*—Finely air-slaked lime, sown broadcast over the ground before the corn is planted, at the rate of from twenty to one hundred bushels per acre.

4. *Gypsum.*—Ground gypsum, or plaster, strewn broadcast, at the rate of from a half to two bushels to the acre, or a spoonful or small handful of plaster applied to each hill of corn as soon as the plants appear above ground. Cultivating and plastering corn in dry and parching weather have an excellent effect, as it makes the ground moist by attracting the dews of the night. The mere stirring of the soil alone has this effect, as it makes the ground porous or sponge like; but plastering is a powerful auxiliary in securing the necessary degree of moisture, because it attracts moisture from the atmosphere and imparts it to the soil. Plaster will nearly double the product of corn on sandy lands, gravelly knolls, and slaty hillsides, but seems to do but little good to corn-growing on clay or heavy and hard soils.

5. *Salt.*—Salt sown broadcast, at the rate of from one and a half to four or five bushels to the acre, and harrowed in before the corn is planted.

6. *Wood ashes.*—Wood ashes applied to sandy soils are a valuable manure, and on some soils leached ashes are as good as unleached wood ashes. Land too poor to grow eight bushels of corn per acre has been made to produce forty-five bushels per acre by the use of wood ashes alone, for they stimulate its growth like plaster. Wood ashes, however, are more valuable on a sandy soil than any other, as they enable the sand to retain its moisture—a matter of great importance—hence such ashes are used to very great advantage on the sandy lands of Long island, near the city of New York, and also in the State of New Jersey.

7. *Stone-coal ashes.*—Stone-coal ashes possess the same general nature that wood ashes do, though in an inferior degree, and hence are a good manure for corn crops.

8. *Bone dust.*—Bone dust should be well mixed with fine earth and sown broadcast and harrowed in at the rate of from ten to twenty bushels to the acre before the corn is planted.

9. *Guano.*—Guano mixed with from three to five times its own weight or bulk of fine earth and sown broadcast, at the rate of from two hundred to four hundred pounds of guano per acre, and well ploughed or harrowed into the soil before the corn is planted, or put into the hills with the seed corn at the rate of from two to three table-spoonfuls of this guano and earth mixture to each hill of corn. The pure guano alone might prove too hot for the corn seed, and so should be used very cautiously.

10. *Cotton seed.*—Cotton seed sown broadcast at the rate of from fifty to one hundred bushels per acre before the corn is planted, or put into the hills with the

seed corn at the rate of a handful to each hill of corn. But the cotton seed must be well rotted or decomposed, or it will overheat and greatly injure, if not destroy, the seed corn.

11. *Compost manure.*—Compost manures, composed of fine, rich earth, and wood ashes, stone-coal ashes, lime, plaster, salt, night soil, or human excrement, hen and dove dung, and the like, must be well intermixed and sown broadcast, or applied at the rate of a small handful of the compost to each hill of corn. Wood ashes and plaster in equal parts, well mixed, and applied at the rate of from two to six bushels to the acre, broadcast, or a gill or small handful of the mixture put into the ground with the seed corn, or to each hill of corn after the plants are up, is a valuable manure; also, wood ashes, plaster, and lime, mixed in equal parts, and sprinkled over the corn hills as soon as the plants are above the ground. Some prefer a mixture consisting of three parts of unleached ashes, two parts of slacked lime, and one part of ground plaster well mixed, and applied at the rate of a large handful of the mixture to each hill of corn. Wood ashes, plaster, lime, and salt, mixed together in equal parts, and put under the seed corn at the time of planting, at the rate of a handful of the mixture to each hill, will kill or drive away the cut and grub worm, attract carbonic acid gas from the air, retain moisture, and stimulate and nourish the corn plants, and increase the yield one-third. When wood ashes alone are used it is customary to apply a small handful of it, either leached or unleached, to each hill of corn; and that would, perhaps, be the proper quantity of plaster, or of lime, when they are used alone, while the one-half of that quantity of salt would be sufficient. Some soils will require a good deal more of these, as well as of all the other manures above mentioned, and hence it is impossible to lay down any fixed rules upon the subject. Every corn planter must determine the proper quantities of each for himself, as he best can from his own experience and that of his neighbors.

12. *Red clover and grasses.*—The cheapest, most easily attainable, and best of all manures for a corn crop is a dense mass of red clover, either in its green or in its ripened and dried state, ploughed down to the depth of three or four inches only, just deep enough to prevent wastage, and yet near enough to the surface of the ground to be acted on by the sun's heat and the air, and also in its decay afford certain, active, and constant nourishment to the young and expanding roots of the corn growing over its remains. Corn and wheat grown over clover leas are very generally freer from disease and insects, and better in yield and quality, than crops grown on or with animal manures. A dense mass of timothy, and other grasses, well intermixed in sowing, will produce a like beneficial effect as a manure for our corn crops. But to secure this on our grounds we must manure the clover and grasses, while yet young, with liberal supplies of plaster, lime, and fine, well-rotted stable or barnyard manure, scattered broadcast over the growing plants.

As it requires but little more time and labor to manure your crop well than to manure it poorly, you should be sure to do it well while you are about it, for the greatly increased yield of corn secured thereby will pay very handsomely for that extra time and labor.

HARVESTING CORN AND CORN FODDER.

Indian corn should be harvested as soon as its stalks and leaves are well glazed, or have become whitish and hard for about two-thirds of their distance above the ground. There are various ways of harvesting this crop.

1. Some farmers husk their corn and remove it, leaving the cornstalks stand in the field just as they grew, with all their leaves and nubbins, and at times considerable good corn too, and then turn their hogs and cattle into the fields. Although wasteful and improvident, this custom prevails to a considerable extent, and perhaps necessarily so in our western States, where work hands are generally too scarce to harvest the immense crops usually grown there.

2. Others cut off the tops of their cornstalks, and strip their blades or leaves while they are yet green and tender, and then leave the ears stand and ripen on the residue of the stalks until husking time, say October or November. Careful experiments and comparisons have shown, however, that this mode of harvesting is injurious to the ripening of the grain, and yields a good deal less corn, but some think more and better fodder than either of the following modes.

3. Others, again, cut off the stalks, with all the ears and leaves on, close to the ground, as soon as they are white and dry as high as the lower ears, and shock them in the field until dry enough to house, thus securing a large yield of grain, though not quite equal to that secured by the next mode.

4. Another plan is to wait until the corn is fully ripe and dry, when it is cut off and put, tops, ears, leaves, and all, into shocks in the field, or stored away in an airy barn or shed, and husked late in the fall or in the winter, as circumstances may require or render convenient. This mode is said to yield the best and most grain, while the fodder, in the opinion of some, if well managed, is richer and more valuable than that of any other mode of harvesting yet known.

Each corn planter, however, must judge for himself which of these four different modes of harvesting corn will suit him best. If the tops of the cornstalks are cut off, and their leaves stripped away while yet green, they ought to be well cured or dried before being housed, or be housed in an airy shed or barn, and so loosely that the air can easily pass in among and through them. But stripping the leaves off the stalks is now abandoned by many farmers, who find it less laborious and more profitable to cut off the whole crop close to the ground, as above stated.

If the crop is cut off near the ground while the leaves are green and tender, four, five, or six hills of it only should be set up carefully against and around an uncut hill of corn, and then strongly but loosely tied around the top with a wisp or band of wheat or rye straw. This will keep the shocks from falling or being blown down, while the wind will, in case of rain, easily pass through and soon dry it; but if the corn be cut and shocked like wheat, or rye, the rain will soak into the middle of the bundles, where they are tied, and be very apt to make the ears of corn and the fodder mould and get sour, to say nothing of the extra labor and disagreeableness of working at and gathering water-soaked corn. The stalks should also be allowed to stand in the field until the grain is fully ripened, and the stalks and leaves are quite dry, when it will be an easy matter to cut the still uncut stalks and house the whole crop nicely.

If the stalks are left standing until the corn is fully ripe and hard, or nearly so, they ought to be cut off near the ground, and from twenty-five to fifty hills shocked together against and around some three, four, or five hills left standing uncut, and secured at the top with a loose band, or bands, as aforesaid, until convenient for husking and housing, or regular stacking.

In some neighborhoods it is customary for the farmers to help each other husk their corn, in the pleasant moonlight evenings of fall. And these husking parties, or frolics, which are an unfailing source of amusement to the youth of both sexes, often consist of from twenty to fifty hands, or more, who not unfrequently husk a farmer's whole crop in one evening.

CORN FODDER AND CORN MEAL FOOD.

When we speak of corn fodder we mean the corn stalk and its ear husks and leaves, cut and cured, as already stated. Some of our best farmers are of the opinion that corn fodder, grown upon a rich soil, will pay for harvesting the crop—that it is better food for cattle than wheat or oat straw, and worth as much or even more than hay itself for milch cows and young cattle, especially if harvested at the right time and well cured, and cut fine and steamed or scalded before feeding to the cows—and that corn fodder is still better if mixed with wheat,

rye, or buckwheat bran, or ground corn, or oat meal, and sprinkled with a little salt. Some, however, are still of the old opinion that corn fodder is inferior to timothy or clover hay as a cow and cattle food, and it certainly is so when badly harvested and cured, as is often the case. The value of corn fodder is, in fact, greatly underestimated, but that value, it should be borne in mind, depends very much upon cutting it at the right time, and curing and housing it well before its strength or saccharine juices are washed away by our heavy autumnal rains. It should also be borne in mind that if cornstalks are cut too early, or while yet green, the saccharine matter or juices contained in them will turn sour, and become vinegar instead of sugar, and so lose their nutritive powers, hence they should never be cut until nearly or fully ripe.

Many careful experiments and comparisons have also proved most satisfactorily that corn itself fed to horses, mules, sheep, milch cows, and other cattle, and hogs, in a raw, whole, or unground state, is from one-third to one-half less fattening than the same amount of corn ground into meal and well cooked or boiled; that corn boiled whole or soaked only in water until it is soft, is also more fattening than raw-fed corn, but less fattening than boiled or well-cooked corn meal. A considerable portion of the corn fed to cattle and hogs in a raw or unground state is always swallowed without being masticated, and passes through the animal whole, as we see from its excrements, and of course, being entirely undigested, has done no good whatever. Ground corn, on the other hand, particularly if cooked or boiled, not only nourishes but also relieves the animals from a large portion of that labor or action of the stomach requisite to the digestion of whole corn before contributing to the animal's blood or vital power. And when corn is mixed and chopped or ground up with oats or rye, it is still more valuable, because less heating to the animal, and also less productive of costiveness and colic than when fed raw or alone. Cows will also give more milk and hogs fatten sooner on scalded or boiled corn meal mixed with apples, pumpkins, potatoes, carrots, turnips, or other roots, or bran, or the common slop of our kitchens, slightly salted, than they will or can on corn meal alone. Even the cob of our Indian corn contains some nourishment, a good deal more than most people are aware of; hence it may, and in times of high prices for corn ought to be, ground up with the grain to fatten hogs and beef cattle. This is not its only recommendation, for it also increases the bulk of the food, and thereby renders it more digestible and wholesome than the pure corn meal alone.

Indian corn has become so important and valuable a food in our country, both for man and beast, that it is fully equal and in some respects superior to wheat, as it grows well in all the States, and is a surer and more abundant crop; hence, more reliable as a source of revenue than any other of our cereal grains. It produces more bread, meat, milk, and butter than any other crop of grain. In our southern States it forms the constant and principal food for man and beast, and poultry of all kinds. It makes fat steers, fat bullocks, fat cows, fat hogs, and fat poultry, and these in their turn enrich the tables for the use of man; hence our people have great reason for regarding Indian corn as the "king of grains," "the staff of life," "the great stand-by of farmers," &c. And he who considers its excellence and cheapness as an article of food, and the many useful purposes to which its stalks and leaves can be applied, will certainly not deem this praise extravagant.

Southern people prefer the white corn for breadstuff, as it makes a sweet, white, and beautiful meal for bread, corn cake, and hominy, and their cooks have acquired great celebrity in making those articles; but northern people generally prefer the yellow corn for all these purposes, as it makes a richer colored and more nutritious food. The white corn of the south contains the most albumen and starch, while the yellow corn of the north contains the most oil and gluten; and the yellow is, on this account, deemed the best corn for shipping, as it is less likely to sour. But thoroughly kiln-dried white corn will also answer for shipping. The yellow corn makes a dry and hard bread, as its flour is oily

and not adhesive enough in its particles to rise and make soft bread. But if its flour is mixed with a sufficiency of wheat or rye flour to make the mixture adhesive, it will make a light, soft, rich, and very superior bread and cake. It is usually mixed at the rate of about one-third wheat or rye flour to two-thirds of Indian corn meal

VARIETIES OF CORN.

There are many different varieties of corn, which I have no time to describe, but that which, upon the whole, will be the best for the planter, depends entirely upon the nature of his soil and climate, as the kinds that do very well in some regions often fail in others. When you have obtained the variety that succeeds best upon your soil, you should be very careful to keep its seeds pure and unmixed with other varieties, or it will soon lose its distinctive character. In order to preserve this purity the better two or more varieties should never be planted together, or near each other, because experience has shown that they will intermingle and gradually assume a general conformity in appearance, habits, and quality, with the common standard sort of the neighborhood. The oil contained in our yellow corn is a most valuable part of its composition, as it renders the grain harder and less liable to mould or spoil in very wet weather, or when stored in a corn-crib. The meal or flour made from yellow corn is also less liable to ferment and turn sour, and is more nutritious for fattening cattle, hogs, and poultry, than the white and nearly oilless varieties of Indian corn, though it is not so easily digestible by man.

CALIFORNIA PRODUCTS.

It is but a brief period since California was regarded as a land of mining and uneasy adventurers, for whose subsistence during their migrations or temporary sojourn supplies would be required from other portions of the coast or from the States; yet in eighteen years from the date of settlement by its present population millions of bushels of wheat and millions of pounds of wool are annually sent to the States or to Europe; all kinds of farm products abound at reasonable prices, and the people are compelled to turn their attention to the manufacture of these surplus products of agricultural industry.

The average yield of wheat is estimated in California at 24 to 26 bushels per acre. If the estimate is not too high it is twice the average product of the Atlantic States. Excessive results are also reported in the culture of other cereals.

While thus surpassing the productive capacity of the older States in the substantials of agricultural production, the cultivation of semi-tropical products is not only assured, but is already affording freights to shipping and contributions to commerce. The grape crop, yielding wine and raisins, is attaining commercial prominence; oranges of fine quality are produced, (one tree, bearing 464 oranges on the first of January, 1867, 12 years from the seed, had withstood the winter's cold down to 21°;) olives are grown and olive oil of excellent quality; and almonds, English walnuts, and other fruits are cultivated with success. As a fruit region, California evidently has in prospect a future of abundance and wealth.

IMPROVED FARM IMPLEMENTS.

BY S. EDWARDS TODD, NEW YORK CITY.

The object of this essay is to advise the farmers of our country of improvements in some of the implements of husbandry, to facilitate the labors of the farm and garden. The developments in improved farm implements during the last ten years have been really wonderful, and the man who has not kept himself posted in regard to the new inventions of hand tools and horse implements is filled with astonishment when advised what ingenious inventors and skilful mechanics have accomplished, and what they are now doing to relieve farmers of the heavy and irksome drudgery of the farm. Indeed, the improvements in agricultural implements have been characterized by such eminent ability, that at the last international exhibition it was repeatedly observed that the Americans, by their superior ingenuity, had beaten the English on their own ground, in the exhibition of superior implements of husbandry.

My aim is to give illustrations and descriptions of the best hand tools and horse implements that are now manufactured throughout the United States. Of course there are many really meritorious horse implements that I cannot notice; and before publication there may be others brought out that will far excel anything illustrated and described in these pages. Skilful and experienced mechanics are not only surprised to see such a commendable spirit of invention among their fraternity, but they are astonished at the inventive ingenuity and skill of intelligent farmers, who aim to economize labor and appropriate the forces of the farm to the best possible advantage.

The exceedingly high wages required for manual labor in this country has prompted our farmers to bring out machinery with which they can perform the heavy labor with teams, which are far more capable of exercising muscular force than human beings. Only a few years ago a farmer was required to employ, feed, and pay a large gang of strong men to do a little work which could all have been performed in a shorter period of time by means of his idle, fat horses, if the necessary machinery had only been provided. But now we see one man and a boy, with a single team, accomplishing tasks which formerly required a score of faithful and strong laborers to perform; and by means of a team and improved machinery a given piece of work is accomplished sooner and in better order than when men performed the labor and fat horses stood idle in the cooling shade. Many of our implements, it is true, have not been brought to that degree of perfection which is desirable, yet they may be classed among our most efficient machines ever invented.

LABOR-SAVING IMPLEMENTS.

In agricultural dynamics, the effective force of a horse is computed to be equal to the power of five strong, active laborers. This fact furnishes a starting point with which to compare the efficiency of any farm implement. If a span of horses and one man can perform as much labor with a certain implement as could be done in the same period of time by the united force of eleven laborers, we feel warranted in pronouncing that implement or machine a triumphant success. On the contrary, if a man and a team of two horses or two oxen are not able to accomplish as much labor as could be done by eleven active men, the machine needs further improvement.

Most of the improved farm implements that have come into general use are capable of performing all that is required of them. Indeed, many of them possess such wonderful efficiency that a single horse or mule and an active boy can perform more labor, and do it better, than twenty men would be able to do with hand tools.

Alden's horse-hoe, noticed in another part of this chapter, affords an illustrious example of a farm implement, the efficiency of which rises far above the common standard of merit. Our best mowers and reapers, horse-rakes, hay tedders, horse-forks, and threshing machines, possess wonderful efficiency, and in some instances so far exceed the standard of merit that comparison makes the standard appear insignificant.

Although there is a growing and almost imperative demand for improved farm implements, there is still a great lack of efficient labor-saving machines for performing many of the manual operations of the farm, now accomplished by tedious and expensive manipulation.

Our late civil war stimulated inventors to bring out improved implements to enable farmers to do almost everything in the field and in the barn with horses, oxen, or mules. Had it not been for efficient farm implements during that long and bloody war, our farmers could not have mowed their grass, gathered their hay, or harvested and threshed their extensive fields of grain. As thousands upon thousands of our young men were called to the field of mortal combat, it seemed almost like an interposition of Divine Providence that inventors were endowed with sufficient mechanical skill to construct implements with which horses could perform the labor of the absent son or father, who had gone to defend his country and to fight for his wife and children. Now, the infirm and the invalid, the lame and the lazy, who could never plough the fields, harvest the grain, or make the hay of a small farm, can ride to plough the land; ride when putting in the seed; ride when scattering their fertilizers; ride when cultivating the growing crops; ride when mowing or harvesting; ride when raking, and ride in an easy seat and accomplish more hard work in one hour than could be done in ten hours a few years ago, even by laboring with all the might of a strong man.

When I revert to the days of my boyhood, when laborious manual drudgery seemed to be the destiny of the toil-worn farmer, and witness what has been wrought out in the line of improved farm implements to relieve the heavy labors of the tillers of the soil, I am cheered by the encouraging prospects which are looming up in the hopeful future, when mind, science, intelligence, and labor-saving machinery must emancipate the bondman of the farm, and lift him up to the true dignity of manhood. Mind must eventually triumph gloriously over matter; and it is incumbent on every farmer to tear away from these old practices of our fathers, in which our bodies were employed as mere machines for performing what the horse or a steam-engine should do.

AGRICULTURAL DYNAMICS.

It is of eminent importance that farmers should have a more perfect understanding of the strength of the materials of which their implements are made, and the most economical and effective velocity for the moving of different parts of complicated machinery. Manufacturers of all kinds of farm implements should understand well the laws of force and motion; and whether a given operation is performed, for the most part, by *muscular force*, or by the *momentum* of a machine, as the great efficiency of the working parts of a machine depends almost entirely on the proper weight, or the most economical velocity, of those parts that perform the operation required. I will illustrate my meaning: When a given operation is to be performed by machinery, if the work be light, it becomes necessary to increase the velocity in order to economize time, and to make a judi

cious appropriation of the force employed. When the work is heavy and the effective force limited, the velocity must be diminished. Were a person, when turning a fanning mill, to attach a crank to the journal that holds the wings or fans, and give the various parts of the mill the necessary velocity, the fatigue would be so great in a few minutes as to cause complete exhaustion. But by employing a system of wheels, so that the action of the muscles may be much slower, the labor may be continued for several successive hours with but little fatigue. This principle holds good in constructing almost all kinds of hand and horse implements. There is a certain movement, or velocity, of the various parts of almost every implement or machine which will render the working parts more effective than they would be with a slower or quicker motion, or with a higher or lower velocity.

THE NATURAL GAIT OF ANIMALS.

As we increase the velocity or speed of a team beyond a certain pace, we diminish their available force in moving a load. On the contrary, we may not be able to avail ourselves of one-half of their force, because they are not allowed to move at their natural gait.

Good teamsters, if they are as ignorant of science as the beasts they drive, understand that it is far better for their teams to take a load only as heavy as they are able to draw and move with their natural gait than to go twice with half a load, making two journeys in the same period of time. This principle is too frequently lost sight of in performing many of the manipulations of the farm and workshop where the force of man and animals is exerted.

There is a degree of rapidity in the action of the muscles of man, beasts, and birds, common to each, beyond which, if the action of the muscles be pressed, the fatigue will soon produce complete exhaustion. If a man were to attempt to move his extended arms with the rapidity of the wings of a dove, he would be very soon exhausted. If a man were to move his legs in walking or running with the rapidity of a very little lad, the fatigue would be so great on the muscles as to soon produce exhaustion. The idea to be kept in mind in adjusting the velocity of a team drawing an implement from place to place, or in propelling machinery, so as to give the correct velocity to the various parts of machinery, is to have every part move forward or revolve with a velocity which will produce the least fatigue on the muscles, and at the same time perform the operation desired with the greatest efficiency.

VARIABLE VELOCITY.

The proportion between the velocity of a body and its weight is a subject of vast importance to the tyro, particularly in practical agriculture and the affairs connected with it. In order to make the most economical disposition and appropriation of the force of his laborers and of his team, and to save the greatest amount of time, it is very important to know with what velocity both they and the machinery employed should move. There is a certain velocity necessary in almost every operation of the affairs of the farm and work-shop, from which if we increase or diminish, we do it at the expense of time, or labor, or of both. He who exercises the greatest economy in saving time, and makes the most judicious appropriation of his force in performing a given operation, will, unquestionably, succeed best in whatever he undertakes. When the force of either men or animals is employed to perform a certain operation the muscles are fatigued. The fatigue thus produced does not depend entirely on the actual force employed, but in part upon the frequency with which that force is exerted. In accomplishing every piece of work by muscular force, the exertion consists of two parts. One of these parts is the expenditure of the force required to drive the instrument or tool; and the other is the effort required in giving motion to the limbs of the man

or animal which produces the action. For example: a man in driving stakes into the ground with a sledge expends a certain amount of force in propelling the sledge against the stake; and a certain amount of force must first be expended in elevating the arms and sledge for the purpose of striking. Both of these operations produce fatigue on the muscles. If the sledge be a heavy one the greatest part of the exertion will be required in striking. But if the sledge be rather light, the exertion necessary to raise the arms and the sledge will produce the greatest fatigue on the muscles. It not unfrequently happens that, in performing certain operations in which very little force is required, if very frequently exerted, the muscles will be more effectually fatigued than when engaged in more laborious work. It is of first importance to adjust the weight of different tools, and the velocity with which they must be moved, so as to produce the greatest effect with the least fatigue of muscles.

THE CORRECT VELOCITY FOR MACHINERY.

In adjusting the velocity for a buzz-saw, to be driven by a railway or endless platform horse-power, for example, if the driving wheel be so small, and the pulley on the saw-shaft so large, that the horses must walk faster than their natural gait, they will very soon become jaded by performing a limited amount of labor. On the contrary, the driving wheel must not be so large, and the pulley on the shaft so small, as to give a very high motion, because, in the latter case, very much of the available force of the horses will be lost in merely giving the saw a certain velocity, which is all they would be able to do when the saw was not in use. There is no danger in having a buzz-saw revolve with a very high motion, providing there is an abundance of available force to keep the velocity or motion up to such a point. This holds good, also, with respect to a cylinder of a threshing machine and many other machines. Sometimes machines are geared to run with such a high motion that it requires the force of another horse-power to perform a given operation, simply because the motion of some parts of the machine is much higher than is necessary.

One of the most important considerations to be kept in mind when constructing an implement, is to so arrange the working parts that the team or the laborer, or both, may move in their natural gait, and at the same time give the working parts of the machine or implement the most effective velocity.

HEAVY VS. LIGHT IMPLEMENTS.

Many people appear to be unaccountably stupid in regard to the most economical and convenient weight of implements and vehicles, and especially the weight of one-horse and two-horse vehicles. A large proportion of the four-wheeled and two-wheeled vehicles in use are sufficiently heavy and strong to bear three times as much, with entire safety, as they usually carry. The two-wheeled coal and dirt carts are often sufficiently heavy for a single horse without any load on them; and the huge four-wheeled express wagons are almost always built sufficiently heavy to carry with safety all that four or six horses ought to draw. There is great need of an improvement in regard to the weight of almost all kinds of implements and vehicles. A horse of ordinary size will draw, on a smooth road, one ton anywhere, with ease, besides the vehicle of suitable weight for one animal. In hauling earth of any kind, or stone, one horse would take 2,000 pounds with no more fatigue than he now feels when he hauls only seven or eight hundred pounds on a large lumbering cart, many of which will weigh ten to twelve hundred pounds without any load. It is truly suprising that intelligent men do not perceive this fact. By reducing the weight of a vehicle six hundred pounds, which could often be done with consistent strength, the team would be able to haul six hundred pounds more of earth or stone at every load, by exerting only the same strength. The same principles hold true in the construction of hand

tools. A laborer shovelling earth with a shovel only one pound heavier than a neatly made light shovel, will exert strength to no purpose sufficient to throw up one pound of earth at every shovelful, which would amount to several tons in a short period of time. Many excellent teams are well nigh ruined in consequence of a ponderous vehicle, as most teamsters are too apt to be governed by the number of pounds that is placed on the vehicle as a load, rather than by the weight of the wagon or cart, and the load in the aggregate. When farmers are hauling material of various kinds, they are not always aware of the unnecessary weight they require their teams to haul to and from the field. Hay riggings are frequently made more than one hundred pounds heavier than is necessary. If only made as light as consistent strength would admit of, a team might haul one hundred pounds more of hay and grain just as well as to draw the same number of unnecessary pounds of rigging. Ploughs are frequently made twenty pounds, or even more, heavier than is really essential to secure the necessary strength of materials. Every good ploughman knows that an addition of twenty pounds to a plough that is already as heavy as it ought to be, greatly augments the fatigue of the team, and renders ploughing far more laborious for the ploughman than if his implement were as light as ploughs might be made for ordinary work. Farmers should study the strength of materials for the purpose of ascertaining as nearly as practicable how light every implement may be made consistent with strength.

SUGGESTIONS ABOUT THE WEIGHT OF IMPLEMENTS.

The greatest possible efficiency of certain implements depends, aside from the condition of the cutting edge, on their proper weight. Implements that have a cutting edge can usually be made much lighter than they are now manufactured, providing skilled laborers are employed to use them, and providing, also, it is not necessary to increase the weight of certain parts, for the sole purpose of guarding against any casualty.

The weight of many mowers and reapers might be reduced fully one-third, and sometimes one-half, where there are no stumps, stones, or other substances to encounter, and none but skilful laborers are to run such implements. The weight of the gear wheels that drive the knives of some mowers might be made one-half lighter, and then possess double the strength required to work the knives, when the machine is moving through the tallest heaviest grass or grain that any farmer ever raises. Almost all kinds of tools and farm implements are too heavy.

FLY-WHEELS AND TOOTHED-WHEELS.

As fly or balance wheels are employed on many kinds of machinery, and frequently misapplied, it is highly important to know when a fly-wheel is an advantage, when it would be a decided disadvantage, when it is too heavy, and when not heavy enough. Many farmers, as well as many mechanics, cherish the erroneous conclusion that there is great power in a fly-wheel, as well as in large and heavy toothed-wheels which perform the office of a fly-wheel.

There is no power in a heavy wheel of any kind. It only operates as an accumulator of the effective force which is employed to drive the machinery. When the application of force, for any purpose, is intermittent, a fly-wheel may be employed with excellent effect, as the wheel will accumulate the force that drives the machinery, so that the working parts may operate more effectively than if there were no fly-wheel. I will cite instances, so that both farmers and mechanics may have a better understanding of the construction of machinery.

A fly-wheel on the journal of a grindstone would be a decided disadvantage, except when the stone is turned by the foot. The operation of grinding being one steady and continuous absorption of the effective force that is employed to turn the stone, every additional pound that is added to the journal absorbs a

proportion of the effective force of the team or steam engine. A fly-wheel on a hand corn-sheller, or hand straw-cutter, weighing 100 pounds, would not be so convenient nor so economical of the force as a lighter wheel, because a large, heavy wheel would absorb too much of the power that ought to be employed in cutting straw or shelling the grain to give motion to the wheel. The weight of a balance-wheel must be regulated by its velocity, when the power is limited. Where there is an abundance of power, a heavy wheel is preferable to a light one. It should be the aim always to have the fly-wheels, or those wheels or parts of machinery that subserve the purpose of a fly-wheel, of a weight corresponding to the effective force; otherwise there will be a loss of the available power of the team. When any part of the machinery is too heavy for the force employed to put the various parts in motion, there is a great loss of power.

When I was a young man I had a foot turning-lathe which was worked by a driving-wheel about five feet in diameter, weighing some two hundred pounds. I could drive the lathe with my foot, and turn wood at the same time, in a very satisfactory manner. At the suggestion of older mechanics, I put a much heavier wheel, seven feet in diameter, on the same journal; and I was never able to drive the lathe with my foot so as to turn out a single stick. The large heavy wheel absorbed all the effective force of my foot to impart motion to the mandrel, so that when I applied the chisel, there was no force to overcome the resistance when the gouge or chisel encountered the wood. Of course, the large wheel was necessarily removed, and another substituted that would give about the desired velocity, and which was not too heavy for the force employed to drive the lathe.

HOW MUCH IS A DAY'S WORK.

In order to appreciate the eminent advantages of employing labor-saving implements worked by teams, for doing the manual labor of the farm, let us compare, still further, the amount of labor performed by one man, without the aid of horses, with the work done by men and machines.

An ordinary laborer will thresh and clean about six to seven bushels of wheat in a day, taking the country through. In some grain districts, one man will thresh ten or twelve bushels of wheat and clean it, while in others he cannot thresh more than five bushels, if he threshes out all the grain as clean as the work is done with a machine. It must be borne in mind that it will require more hard pounding with a flail to thresh out the last quart of grain in a "flooring" than was necessary to thresh the first half bushel.

I have threshed a great deal of grain of all kinds, with my own flail; and I have talked with others who have been accustomed to thresh their grain with flails; and I have come to the conclusion that the following figures represent a fair average as to the quantity of grain that an ordinary laborer will be able to thresh and clean in a day, viz: Seven bushels of wheat, eighteen bushels of oats, fifteen bushels of barley, eight bushels of rye, and twenty bushels of buckwheat. In order to make this more intelligible, it will be necessary to double the number of bushels that one man is able to thresh, as two men will be required to clean the grain with a fanning mill.

In order to labor economically and advantageously with a threshing machine, two horses, at least, and three men are necessary. In most instances four or five men will be required, which will make a force equal to fifteen men with flails. Such a gang of hands, and two good horses, with such a thresher and cleaner as Harder's, on a succeeding page, are capable of threshing and cleaning, of the same kind of grain to which allusion has been made, one hundred and seventy bushels of wheat, three hundred and twenty-five of oats, two hundred and twenty of barley, one hundred and eighty of rye, and two hundred and sixty of buck wheat. Some manufacturers of threshing machines fix the average day's work higher than these figures. In some instances, I will acknowledge that a span

of horses and five men can do much more than the amount represented by the foregoing figures; yet I am satisfied that in the majority of instances they will not thresh and clean a greater number of bushels than I have indicated. But, even at the low figures that I have recorded, such a machine as Harder's, or Palmer's Climax, or Wheeler, Melick & Co.'s, will be found to be a great labor-saving machine for threshing all kinds of grain.

There is one consideration that should not be overlooked in this estimate, which is the much greater amount of labor performed, with far less fatigue. When one laborer can perform the work of two or more workmen with less fatigue than has usually been required, a great point is gained in agricultural dynamics.

AGRICULTURAL ENGINEERS.

What wonders have been wrought in farm implements in the brief space of forty years! The young men of our country cannot appreciate the great contrast between a complete set of farm implements forty years ago and the hand tools, implements, and machinery required at the present day to constitute a full set of implements. Forty years ago a farmer could carry all the tools required on a farm of ordinary size, in an ox-cart, at one load; but to-day, the tools and machinery on that same farm cannot be transported in six ox-carts. Let us, for a moment, direct our attention to the implements for gathering a crop of grain, and preparing it for market. Then, a cradle worth $2.50, and a rake worth twenty-five cents, a flail fifty cents, and a fan for cleaning the grain worth $1, was about all that was required; but, to-day, the mower, and reaper, and the threshing machine must be brought into requisition. Almost every operation must be performed by efficient and complex machinery, requiring years of practical experience to manage with skill and efficiency. Almost every operation is performed on the farm by some kind of implement, which requires more wisdom, judgment, and discretion to put it in order and to keep it from getting out of order, than an engineer exercises in running a steam engine.

We are a nation of scientific inventors. Every week or every month, developments in labor-saving machinery are given to the world, that astonish everybody. The man who launches forth in some new enterprise, flattering himself that the world will stand aghast before his profound wisdom, is almost overwhelmed with chagrin at the thought that some live Yankee is close at his heels with an invention which will eclipse the brightest feature in his machine. As men become familiar with the laws of matter, and acquaint themselves with philosophical and mechanical principles, they discover how easy it is to make an application of their knowledge in improving some of the implements of agriculture.

INVENTING LABOR-SAVING IMPLEMENTS.

Robert Fulton invented the steam-engine. Mechanics and engineers who lived before Mr. Fulton's time understood the power of steam; but they did not know how to confine it, so as to make its force available in driving machinery. After the principle on which the steam-engine operates was disclosed, mechanics grasped the thought and rushed forward with eager haste to make improvements in the working parts of the steam engine. There is no implement or machine, which is made of several different parts or of various forms, that was invented and brought to its present excellence and efficiency by the effort of one person. Our best and most effective agricultural implements have been developed little by little, by the united efforts of several thinking, scientific individuals. One man has invented one part, and another person has brought out another part. One man has applied his knowledge to the improvement of some invention which his predecessor had made as perfect as he was able with his limited ability; yet, there has been an untold amount of misdirected effort to bring out something useful, simply because inventors did not understand the principles of mechanics,

and did not possess that knowledge of agricultural dynamics which is essential to success. Inventors should be practical men, understanding fully the nature of the operation to be performed, the force required to accomplish a given result, and the amount of resistance to be encountered and overcome by the machine.

An inventor should understand enough of machinery, and of the labor to be performed, to determine at a glance whether more of the effective force will be absorbed in giving the requisite motion to the parts of the machine than there is in performing a given task.

STUMP AND ROCK MACHINES.

Any kind of machinery for extracting stumps or for lifting rocks may seem of little value to the farmers who reside where the country is smooth; but it should be remembered that untold numbers of townships are yet covered with forest trees and rocks, all of which must be removed before the plough, the cultivator, and the mower can be used; consequently, for the performance of this heavy work, the most convenient and effective machinery is necessary. Clearing land of stumps and stones is expensive labor; and it is a matter of congratulation to reflect that American farmers have access to the most convenient and effective machinery that can be desired for lifting heavy rocks, or for taking out large or small stumps.

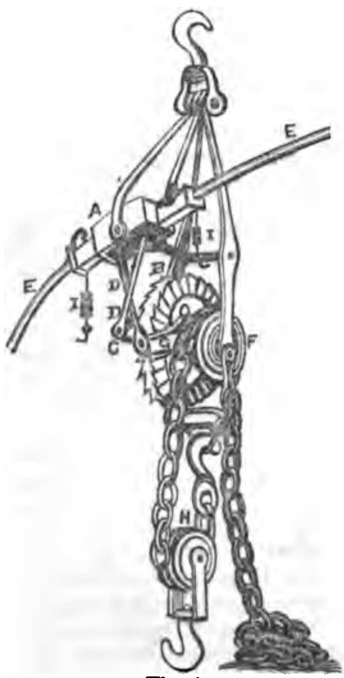


Fig. 1.

CRAWFORD'S STUMP EXTRACTOR AND ROCK LIFTER.

The accompanying illustration, Fig. 1, represents the principal working parts of this powerful rock lifter.

The working-beam A, connected with a ratchet wheel B by pawls C C and cross-hangers D D, so that when the beam is rocked by means of levers E E the wheel is kept in motion, carrying around with it a sprocket or chain-wheel F, to which it is cast solid, and over which a heavy chain G passes, and is kept from slipping by flanges projecting between the links, so that the more weight there is attached the more securely it is held to the wheel; while any length of chain may be used, and a body raised to any height. To double the power and strength of the machine, a heavy iron pulley H is attached, as seen in the cut. To reverse the action of the machine, spiral springs I I, suspended from the arms of the rocking beams, are hooked to the cross-hangers, and with the same motion of the levers the wheel turns back, lowering the weight as far as necessary

Fig. 2. represents the machine suspended by sheers S S S, showing the usual method of extracting stumps, so they can be left in any position desirable. Small drags or shoes, T T T, are attached to the feet of the sheers, (by irons furnished with each machine,) so that with two connecting or drag-chains, U U, the whole is moved by a horse or oxen from stump to stump, or rock to rock, requiring but little adjusting at each operation. Or it may be moved by the more laborious mode of lifting it by pins driven through the sheers about two feet from the lower end. These pins should be attached to each set of sheers.

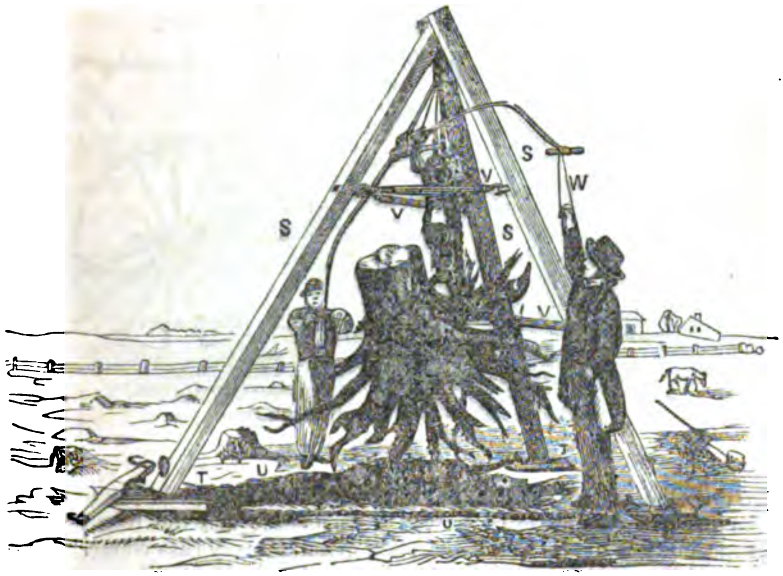


Fig. 2.

Three braces, V V V, are attached to the sheers (by irons furnished for the purpose) to keep them in their relative positions while moving, which should be detached when the machine is in operation with a heavy load, (unless the drag chains are kept hooked, which is not always convenient among lateral roots,) when a little adjusting of the drags is sometimes necessary. A rope, W, is attached to the handles of the levers, when it is necessary to hang the machine high, so the operator can still stand on the ground while working them. These ropes should always be attached, as with two men the machine works easier by the ropes than by the handles, except when great weight is attached. A wrapping chain is passed round the trunk of the stump or a large side root, through the eye or hook of the pulley for the double purchase, or the chain hook for the single purchase, and fastened by a self-fidding lock or ring on the end of the chain, and the machine is ready to operate; or the grapples, which are used for both rocks and stumps, can be hooked to opposite sides of the stump, under the roots, and attached to the machine as seen in Fig. 3. The sheers are the best rig for heavy loads, and owing to its utility and cheapness should be first adopted, and others added as circumstances require.

Fig. 3. represents the machine mounted on wheels, so that a rock or other heavy body may be extracted or raised from the ground, and moved off at once The carriage is easily and cheaply constructed by a man of common ingenuity and the wheels, when not needed with the machine, may be returned to the cart or heavy wagon from which they were taken.

The forward part may consist simply of a cart, or of the fore wheels of some strong wagon. The hind axletree may be ten or twelve feet long, and four by five inches square. It will not be necessary to let in iron skeins into the axle arms, as that will weaken the axletree, and the wear will be only a trifle.

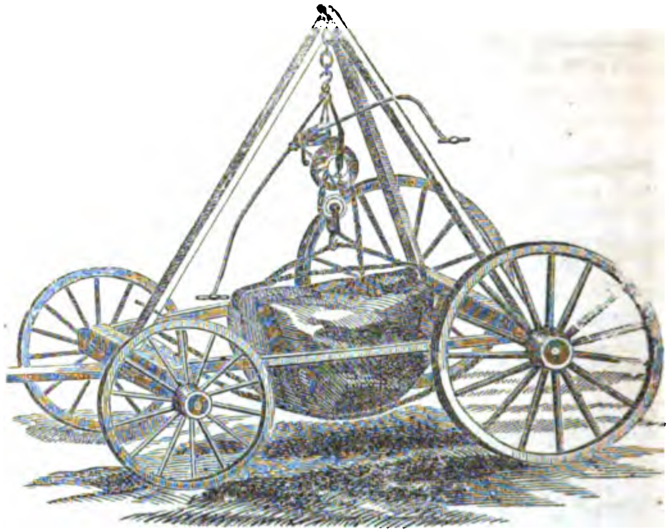


Fig. 3.

The operation of this machine has satisfied the most incredulous of its utility and the great advantages to be derived from its use; and the best evidence of its practicability is the uniform satisfaction given in every case where it has been tested; and the more thorough the test the greater the approval.

It seems hardly necessary for me to add a word in commendation of this great labor-saving machine. Those persons who have had any experience in pulling stumps or removing large rocks, from cultivable fields, will understand and appreciate every part represented by the different illustrations. The name of the inventor of the working part of Fig. 1 is A. Crawford, Warren, Maine. Were a machine required at some distance from Maine, it would be more economical to have all but the working parts manufactured near home, if possible, to save the cost in transportation.

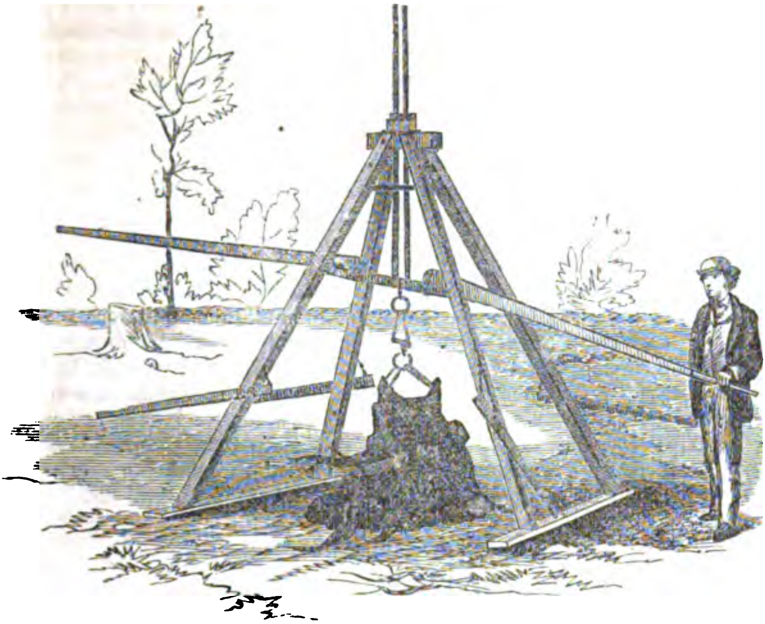
LITTLE GIANT STUMP PULLER.

The most convenient stump puller for extracting small stumps was recently invented by Parven, Bowen & Co., Vineland, New Jersey, illustrated by the accompanying figure.

It consists of a strong frame, about eight feet high, made of scantling, like a large four-legged stool. Two men can lift it bodily, by the handles, and place it over a stump, and lift the stump out of the ground quicker than they can fell the tree with sharp axes. A strong iron yoke is secured in the top of the frame. Two long iron bars extend upwards through the yoke, with a hook and chain at the lower end of the bars. One side of each of the bars is provided with notches about one inch apart. These vertical bars are worked up and down by a long horizontal lever, with a man at each end. As each bar is lifted, an iron pawl drops into one of the notches, thus holding all that is lifted.

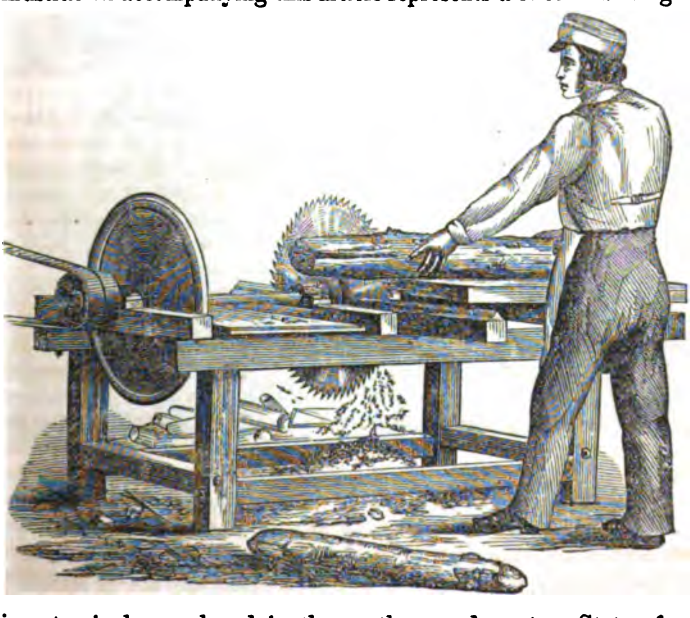
This is a very convenient machine for taking out small stumps and rocks, and

it costs but a few dollars. I saw laborers take out stumps with one in South Jersey, where the tap roots were over six feet long.



CIRCULAR WOOD-SAWING MACHINES.

The illustration accompanying this article represents a circular sawing machine



which is extensively employed in the northern and western States for sawing cord-wood into short or long lengths for the stove. In some instances the fire-

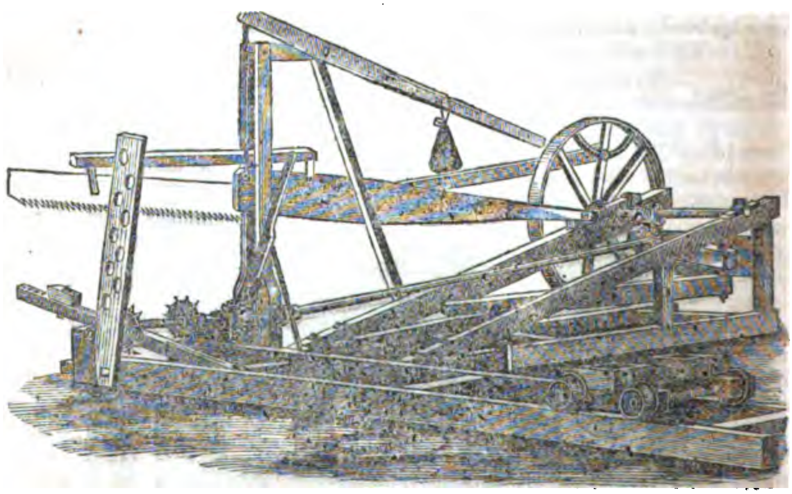
wood is cut and split in long pieces, like long rails, and sawed short with such a machine. This machine is made by G. Westinghouse, Schenectady, New York. R. & M. Harder, Cobleskill, Schoharie county, New York, also make a similar machine for sawing wood. Messrs. Harder employ a lever on the movable table to hold the wood from turning while the saw is passing through a large stick.

One excellent feature of this machine is the plate balance-wheel, which not only prevents sticks of wood getting into the wheel, but is a perfect security against the bursting of the rim when in high motion.

Some wise ones scout at the idea of bursting a good wheel. I have in mind several instances where the balance wheels were bursted into fragments by a high motion. In one instance a man was killed instantly. In another, a portion of the wheel flew more than three hundred yards, and went through the sides of a dwelling-house. In another instance, a hugh iron wheel, weighing several tons, was broken and a large fragment went upwards through the roof of the shop, made a curve through the air over the tops of the buildings in the city of Auburn, New York, and came down more than one-eighth of a mile distant, passing through the roof and floor of a building and entering the ground. This piece of broken wheel I saw, and measured the distance the fragment was thrown. The same year, I was sawing in a machine shop, when the balance wheel on the journal of the saw that I was using, flew into more than twenty pieces, one of them passing through the floor like a bullet. Fortunately no one was hurt. Had they been plate-wheels none of them would have been broken.

WESTINGHOUSE'S DRAG-SAW MACHINE.

On those farms where the timber is sawed into shingle cuts, or cuts for staves, wagon spokes, chair rounds, or firewood, horses or steam engines may be employed with eminent advantage, as one span of horses, if the saw be in proper



order, will cut off more logs than twenty active men with cross-cut hand-saws This machine is designed to be worked by a railway horse-power. The belt communicates the motion from the speed wheel of the horse-power to the large wheel in this frame. One end of the pitman is secured to a wrist-pin, which passes through one of the arms of the wheel, while the saw is attached to the other end. On the journal of the large wheel there is a worm which works in the cog or toothed-wheel on the journal which turns the shaft bearing one end of the log. The wheel is brought in contact with the worm while the horse-power

is in motion, and the log is moved forward slowly any desired distance. The rear end of the log is supported by a small truck. The but end of the log rests on two strong cylinder-heads, the periphery of which is provided with short, strong, sharp-pointed spikes, which enter the bark of the log, or the wood, and thus prevent slipping when the power is applied to move the log endways. If desirable, this worm and cog-wheel may be dispensed with, and a wooden roller, with spikes in it, can be substituted in place of the iron journal, so that the log may be drawn endways by a lever applied to the roller.

The engraving can be readily understood by a practical mechanic, so that the machine will require no further description.

TOTMAN'S WOOD MILL.

One of the cheapest and most effective labor-saving implements that I have met with, where a farmer has not the advantage of a railway horse-power for driving a drag-saw, is a wood-sawing machine, made by Reynolds & Totman, Fredonia, Chautauque county, New York. The accompanying illustration will furnish a fair idea of the horse-power, which is a sweep- power, and may be operated by one horse, or two horses abreast, which are amply sufficient to drive the saw. The horse-power is a paragon of wonderful ingenuity, and yet it is so plain that a good mechanic will at once express suprise that the device has not been thought of before. The wheels cannot be shown advantageously by an engraving; therefore I will endeavor to describe the various parts.

There are three wheels for producing the motion of the saw. The first and largest wheel is made of cast iron, about four feet in diameter, with teeth, or cogs, on the periphery. This large wheel is bolted firmly to the frame, so that it never turns around. The small pinion of the second wheel plays in the teeth of the rigid wheel, and as it turns on its own axis, it travels around the large rigid wheel. The journal of the third wheel passes down through the hub of the rigid wheel, turning in the hub as in a box. On the lower end of this journal there is a balance wheel, with a wrist-pin in one of the arms, to which the pitman is attached. All the wheels play horizontally, instead of working in a vertical position. The tramway and crosshead of the pitman work in the frame beneath the platform, or wooden trunk, over which the team travels.

I have seen one of these machines operate; and, judging from the rapidity with which the saw, when driven by only one light horse, cut off a log of hard wood, I think this is the most economical machine in use, where a farmer proposes to construct a machine solely for sawing firewood, or cuts of trees for timber. I witnessed the operation of a saw when driven by one poor horse, when it cut off a tough-elm log fourteen inches in diameter in eighteen seconds.

HOW TO PUT A SAW IN ORDER.

A saw of any kind is a peculiar tool to put in order. It requires much more mechanical skill to file and set a saw than to hone a razor well. The eminent efficiency of a saw depends, if the blade has the proper temper, on the manner of

filing and setting the points of the saw teeth. There are a few general principles to be understood in filing and setting the teeth of saws of all kinds, which, if observed practically by the filer, there will be no difficulty in putting a saw in excellent condition for sawing with great rapidity. The main principles alluded to are these: the teeth of any saw must be of a uniform length, so that the points will all stand in an exact line, or circle. The very points of the teeth do the cutting; therefore the extreme ends must be of exactly an uniform height, so that every tooth may cut a little. If one tooth be a twentieth of an inch longer than the teeth on either side of it, that long tooth, when the saw is in operation, will be required to perform more than it is capable of enduring. For this reason the saw "buckles" or jumps.

This principle may be illustrated by a score of laborers carrying a stick of timber on their shoulders. The laborers represent the teeth of a saw. If a long man is placed in the middle, short men on each side of him are relieved of their burden, which almost crushes the tall man. But if all the laborers are of an uniform stature, every one must bear an equal proportion of the timber on his shoulder. The principle holds equally good in circular saws of all kinds—the cutting points must move exactly in one line or curve.

Another consideration is, the cutting points of the teeth need to be set alternately to the right and left, only a little, just enough to cut a kerf sufficiently wide to allow the blade of the saw to be worked easily back and forth. If the teeth be set so as to cut a kerf much wider than the thickness of the saw blade, the saw will not cut with rapidity and work with ease. It is a common fault with mechanics, when putting saws in order, to give the teeth too much set.

To joint a circular saw, turn it backwards and let the long teeth be ground off gradually, by striking against a piece of grindstone. A convenient way to joint any kind of saw, the teeth of which stand in a line, is to dress out two pieces of inch boards with straight edges and true sides, put the saw between the boards secured in the vice of a bench, and let the points of the long teeth extend a trifle beyond the edge, when the long teeth may be filed off even with the edge of the boards. If the edge of the saw be circular let the edge of the boards be made correspondingly circular. An inexperienced workman may joint a saw, in this way, with great accuracy.

DITCHING MACHINES.

Perhaps no more money has been expended in constructing models of other new farm implements than has been spent in vain endeavor to bring out a successful machine for making ditches. A great many patents have been taken out on devices for cutting ditches by excavation; but nothing thus far has appeared which will excavate a ditch through all kinds of ground.

The mole-drain plough has been introduced in some sections of the country, with quite satisfactory results, where the sub-soil consists of a heavy clay comparatively free from stones and gravel; but where the sub-soil is not uniform in density or compactnesss, and where there are more or less boulders of various sizes in the ground, the mole-plough is of no value at all.

I have in mind fields in central New York in which drains had been made with a good mole-plough; and all who saw the fields acknowledged that the drains in those fields were of no benefit at all. The grand difficulty was that small stones and gravel and mellow earth fell into the water-courses, and rendered the drains utterly worthless.

Several ditching machines have been made for excavating the earth by a system of small ploughs, scrapers, and elevators; but wherever the working parts encountered small stones the machines have failed. Small boulders, inbedded firmly in a heavy and compact sub-soil, present a resistance to a ditching plough that cannot be easily overcome. For this reason the earth in all such places must be dug up with hand picks, which is exceedingly laborious and expensive.

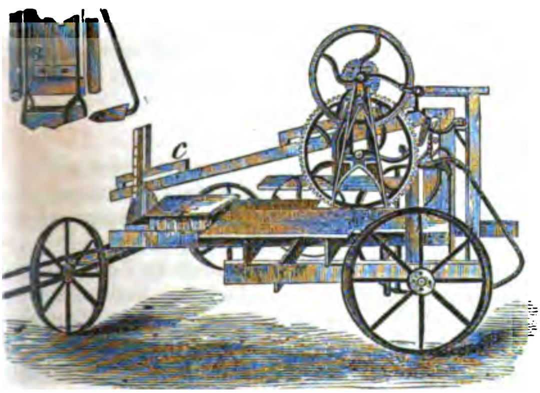
I have experimented for several years past with ditching machines; and in 1866 I applied for letters patent on a device for opening a ditch without excavating the earth. One J. A. Goree, of Alabama, applied for letters patent for a similar device, and the patent was granted to him. Had I received the patent, I doubtless should have brought out a ditcher that would operate most successfully in draining all kinds of ground.

The operation of the ditcher, which I intended to make, may be thus described: a combined beater-wedge, made of iron, having a steel edge, is dropped like a huge hammer for driving piles, with the edge downward, like a ponderous axe, into the ground, forcing the earth horizontally to the right and left. Small stones that would stop a plough would be driven by this beater-hammer either downward or horizontally into the earth. I think that a ditching machine can be made to operate on this principle in a most satisfactory manner. If such a machine can be made to operate satisfactorily, it will be of untold value to other nations, as well as our own. Farmers of America feel the need of an efficient ditching machine more than any other farm implement. Ditching is a branch of farm labor that costs more than such labor is really worth. But, for want of a proper machine, ditches must all be made, in the hardest and stoniest soils, with the pick and shovel.

I have never perceived any difficulty in the operation of such a ditching machine as I have alluded to, except the sticking of the wedge in the earth after it is allowed to drop into soft ground. However, I think that even this difficulty may be overcome by the application of a lever having a short bight or purchase, merely sufficient to loosen the wedge a trifle.

The wedge-beater can be elevated by horse-power; and, in ordinary ground, I think such a machine is capable of opening a ditch sufficiently large for tile, thirty or forty inches in depth, at the rate of one lineal foot per minute. The machinery can be moved forward by a windlass turned with a lever.

CHOATE'S DITCHER.



Mr. George A. Choate, Newburyport, Massachusetts, has in successful operation a ditching machine, which is operated by a system of wheels and levers driven by means of cranks worked by two men. The accompanying illustration represents the ditcher:

It is difficult to describe the different parts of the machine with sufficient clearness to enable a person to understand its construction, without having first seen it in operation. Two active laborers are able to operate this ditcher with a good degree of satisfaction, where the ground is not filled with stones.

Although this ditcher may be recorded as a valuable labor-saving machine, it has not been introduced to any extent, as the inventor has been seriously afflicted with sickness, so that he has not been able to attend to the manufacture and sale of such machines. If certain manufacturers of agricultural implements would open a shop for making ditchers of this kind, there would be a demand for them which an extensive manufactory could not supply.

This machine will cut a ditch of uniform width and depth. By using cutters or diggers of different widths, the ditch can be made four, five, or more

inches broad, and from one to three and a half feet deep. Three men can make a ditch more rapidly with one of these ditchers than ten active laborers with spades, picks, and shovels. The proprietor assures me that three active men have made a ditch one rod long, with one of these machines, in two and a half minutes. The cutters take out the sod in a square form, about five inches wide and twelve or more inches long. This ditcher is substantially made, is quite simple and durable in all its parts, and weighs from ten to fifteen hundred pounds. When in operation, planks are placed on the ground near the ditch, for supporting the wheels. Two men work it, while they stand on the platform; and one man moves the planks, placing them forward of the wheels.

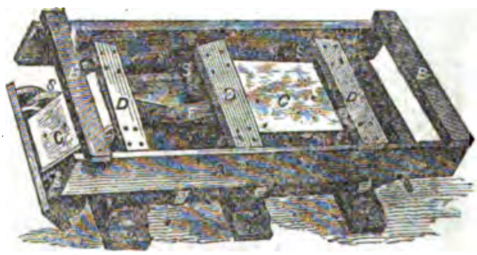
HEATH'S DITCHER.

Edward Heath, Fowlerville, Livingston county, New York, has made an experimental machine for cutting ditches, which operates tolerably well where there are no stones. It is a ponderous machine, supported on four wheels, running on a track of planks. The machine is drawn forward by means of a chain and capstan. Two horses work the machinery for cutting the ditch. The horses are attached to levers, and they travel around the machine, passing over the ditch on a plank or bridge that is moved along with the machine. It is a self-propelling machine; in other words, a certain number of circuits of the horses causes the whole machine to advance one foot or more forward. The diggers enter the ground at the bottom of the ditch and work upwards, bringing the dirt with them; and, as it reaches the surface of the ground, a scraper removes it on the bank of the ditch. There are many ditchers similar to this in various parts of the country; but as they cannot dig where there are stones they have not come into general use.

I have in mind a Mr. Thompson, in the western part of the State of New York, who has expended many hundreds of dollars in experimenting with a self-propelling ditcher, which would cut a narrow ditch, where there were no stones, at the rate of about one lineal foot per minute. But a stone as large as a man's fist would stop its working or break a wheel.

Inventors are laboring with commendable perseverance to bring out a ditcher that will be exactly what American farmers really require for ditching all kinds of land.

LAKE'S AUTOMATIC RAIL-CAR.



One of the most ingenious labor-saving implements of recent invention is a dirt car represented by the accompanying illustration:

It was invented by Jesse Lake, Smith's Landing, New Jersey; and the cars are in use at Elwood, New Jersey, and perhaps at other places. The two large boxes that are mounted on the car are removed. I saw the cars in use, where they were grading through hills; and I know it to be worthy of general introduction. I saw a span of light, old plugs of horses, that wanted a boy behind each one with a cart-whip to quicken them into a moderate walk, move off with comparative ease with a load of earth that would, without doubt, have weighed more than five tons, over an unbeaten track, where they could not have drawn twelve hundred pounds of earth on an ordinary wagon.

The chief excellence of this car consists in this: that it will run about as easily where the ground is soft as where the way is hard. The span of horses alluded to, hauled a car on which were two boxes, about eleven feet long, four

feet wide, and twenty inches deep, both heaping full of earth. The boxes were hung on a swivel, so that one man could dump them without using a shovel.

The car runs on an endless revolving platform. Were the platform of a railway horse-power constructed to revolve below the sills of the frame, so that the entire superincumbent weight should rest on the platform instead of resting on the sills, it would furnish a fair idea of the construction of this car. A, in the illustration, represents a strong plank or sill of the car; B B are cross-ties; D D D are floats, made of pieces of strong plank, about four feet long and a foot wide. There are eight of these floats. Near each end of every float, there is a truck-wheel, some six or eight inches in diameter. C C are stay pieces, and F F are couplings, which serve to keep the floats at a suitable distance apart. An iron way is bolted to the under side of the frame, so as to run over the top of the wheels that are attached to the floats lying on the ground. The difference between this railway and ordinary railroads is in this: the rail is attached to the car, with the wheels beneath the rails.

The team can be hitched at either end, as the car will run backwards or forwards equally well. As soon as the car is put in motion, a float, or plank D, is laid down forward of the car, and the last one is snatched up and rolled forward rapidly and laid down at the forward end to bear up the car, which would sink wagon-wheels in soft earth down to the hub. Such cars will, no doubt, come into general use on the farm, as a span of horses can easily haul five or more tons of compost, sand, muck, clay, stones, potatoes, or any other material across the fields when the ground is so soft that an ordinary wagon would be a good load for a team. More than this, when one man and a single team can haul five tons of material on such a vehicle in the same period of time required to haul one ton or less on a wagon, one can see how much time of laborers and horse strength are saved by the employment of such a vehicle for the purpose of transporting heavy loads over soft ground.

The cash cost of such a car is much less than the cost of a good wagon. The boxes on such a car being much nearer the ground than they are on a wagon, less labor is required to elevate earth into the boxes than into a wagon box. Where roads are being graded by carting the earth from the hills into the valleys, such a car, bearing five tons of earth, will glide over the unbeaten path of dirt with comparative ease to a small team.

PLOUGHS AND SCARIFIERS.

The common plough is an implement of husbandry of unknown origin; but the plough, as we now find it, has been brought to its present perfect form by the united investigations and costly experiments of scores of scientific mechanics. Our first ideas of the common plough are a forked piece of timber, with one prong, iron bound, and drawn through the ground to loosen the soil without turning it over. No one can determine how long this was the most perfect form of the plough. The next step was to fix a piece of wood on one side for a land side, and an inclined plane on the opposite side for the purpose of turning over the furrow-slice as well as might be practicable. This plane or mouldboard was then worked out so that the surface would be as nearly the form of the turning furrow-slice as practicable; subsequently, plates of iron were secured to the surface of the wooden mouldboard. But the common plough, in its present perfect form, has been brought out during the present century. Mr. Jethro Wood, of Cayuga county, New York, who was upbraided with the taunting epithet of a "whittling Yankee," brought out the cast-iron standard and the cast-iron point. It is said of him that he whittled away bushels of potatoes before he was able to bring out a miniature form of a plough that suited him. Large potatoes were whittled into almost every conceivable form before the present convenient and efficient curve of the mouldboard was attained. Although Mr. Wood was one of the greatest benefactors of mankind by this admirable invention, he never received, for all his thought,

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anxiety, perplexity, and expense, a sum of money sufficient to defray the expenses of a decent burial.

After Mr. Wood had conceived the plan of making the cast-iron standard, and had made his patterns for having the different parts of the plough cast, he encountered almost insurmountable difficulty, as the workmen who performed the moulding were disobliging and were filled with prejudice against such inventions, so that Mr. Wood found it absolutely necessary to offer them a liberal bonus before he could induce them to attempt to mould those parts of the common plough that are moulded, at the present day, in almost every village in the country, without the least difficulty; yet, by indomitable perseverance, triumphant success crowned all his efforts in consummating the greatest improvement in the common plough that has ever been made.

HUTCHINSON'S IMPROVED PLOUGH.

After the decease of Mr. Wood, Mathias Hutchinson, of Cayuga county, New York, who is now living, brought out an improvement of great excellence in the common plough, in which the standard is connected with, or is an extension of the land-side of the plough.

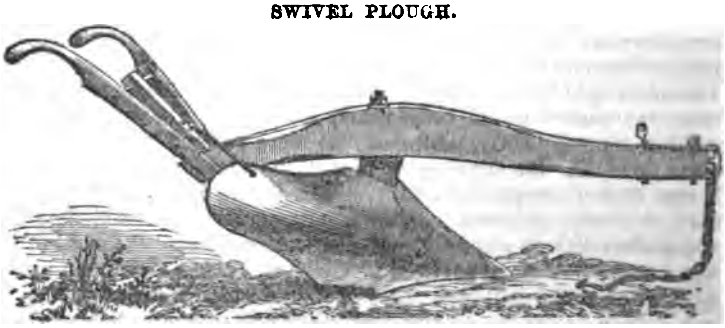
The accompanying illustration will show Hutchinson's improvement in the construction of the common plough, to prevent clogging when coarse manure and stubble are to be ploughed under. It will be perceived that the standard, which is usually attached to the mould-board of the plough, is an extension of the land-side. By this arrangement, a large open throat is formed, so spacious that coarse manure or stubble cannot clog the plough, unless such materials are allowed to accumulate in a heap so large that the furrow-slice could not cover it.

I have used one of these ploughs on my own farm, and have ploughed under long coarse manure, without being required to use any effort to keep the throat of the plough clear, where a plough having the standard attached to the mouldboard would clog incessantly.

It is a strong heavy implement; gives excellent satisfaction among the farmers on the slopes of our northern lakes, where the soil is heavy and stony.

As Mr. Hutchinson is not a manufacturer of agricultural implements, M. Alden & Co., Auburn, New York; C. C. Bradley & Son, Syracuse, New York; and Penfield & Co., Willoughby, Lake county, Ohio, are able to furnish this style of ploughs.

SWIVEL PLOUGH.

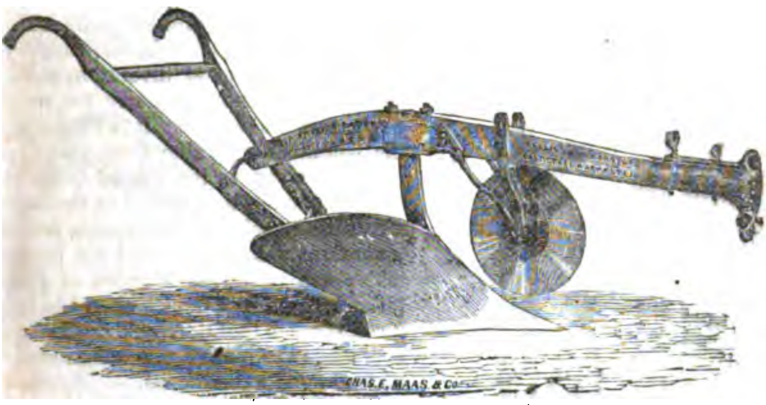


The illustration herewith shown represents a strong swivel plough for heavy work with a double team. It is made by the Ames Plough Company, Boston and

New York; and is designed for ploughing level land, by commencing on one side of the field and working back and forth, without forming any dead furrows. The team, when turning the end, *gees* around at one end and *haws* around at the other end, always turning on the unploughed ground. As a side-hill plough, I believe it operates well. When roads are being made along a side-hill, such a plough as this will be found exceedingly convenient, as the team can plough directly back and forth; whereas with a common plough, the team can plough only when travelling in one direction.

CAST CAST-STEEL PLOUGHS.

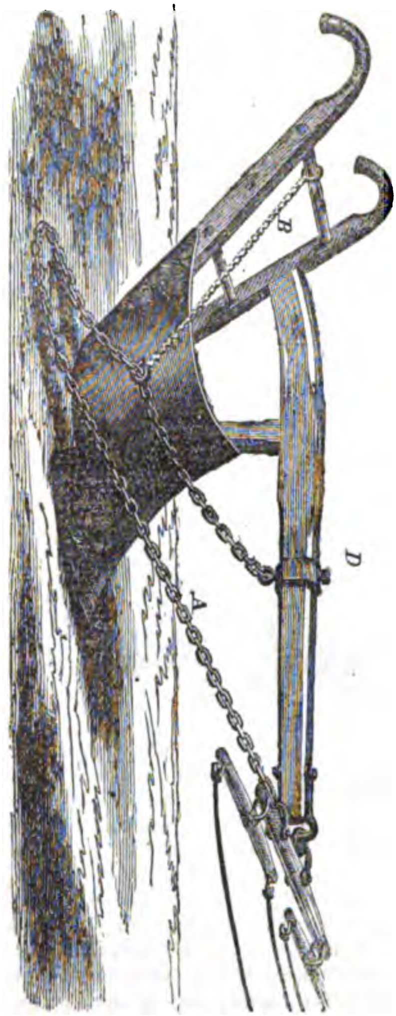
The figure herewith given represents a plough that has become exceedingly popular, and is gaining favor every year. The entire mouldboard, land-side, and share, are made of cast cast-steel. The metal is run in a mould somewhat as ploughs of cast-iron are made.



This style of ploughs is a perfect paragon of neatness and practical utility. Everybody likes them, when they are made right, with a hard temper. They are manufactured by Collins & Co., 212 Water street, New York city, and J. B. Skinner, Rockford, Illinois. No other plough will excel this implement for working in the light prairie soils of the west. When tempered hard, they never clog; but when the steel is soft as iron, so that it can be cut with the point of a jack-knife, fine soil will adhere to the surface and give as much trouble as is frequently experienced with cast-iron ploughs. This plough has been before the public sufficiently long to establish the point that steel ploughs, when the irons are hardened properly, are far superior to iron ploughs, as they will draw much easier and last longer.

But I must record objections that practical men urge against some steel ploughs. In a great many instances, they state that their steel ploughs were not properly hardened, for which reason damp soil would adhere to the mouldboard and cause much trouble. The manufacturers of this kind of ploughs claim that they can and that they *do* make the mouldboards and land-sides much harder than it is possible to harden the sheet steel, of which other steel ploughs are made. When the surface becomes finely polished, no adhesive soil will clog the plough. But when stones and gravel scratch the surface of the steel, it is conclusive evidence that the steel is not so hard as it should be. Remington & Co., Ilion, New York, and M. Alden & Co., Auburn, New York, have also been accustomed to make steel ploughs. At the Peekskill Plough Works, Peekskill, New York, there are about twelve hundred different ploughs manufactured.

PLOUGHING UNDER GREEN CROPS.



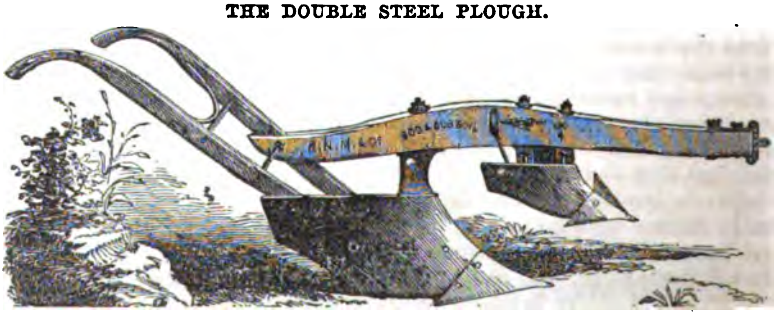
When turning under a crop of red clover, tall grass, weeds, maize or broom cornstalks, farmers have always experienced a difficulty in covering up such materials with the furrow slices. Ploughmen, from time immemorial, have been accustomed to draw under all such materials by means of a chain attached to the plough-beam and whiffletree, as represented by the accompanying illustration.

Although this is an ancient device, but few farmers are acquainted with this mode of dragging the tops of growing plants beneath the furrow slice with a chain; and the contrivance possessed such novelty, that letters-patent were granted to J. & L. Kilmer, Barnesville, Schoharie county New York. It is a good invention, and as it has been common property for so many years, farmers will use it without paying the patentees a royalty, from year to year. The examiners in the Patent Office ought to have been so well posted in the improvements in agricultural implements and useful inventions, that they would not have committed the egregious blunder of granting letters-patent on a device that has been in general use in the Old World and in America ever since the plough was constructed with an improved mouldboard.

The object of the small chain B extending from the large chain to the plough-rong, is to keep the bight of the large chain as far back, and upon the turning furrow slice, as it can be without being buried beneath it as it turns over.

With a chain attached to a plough in this manner, I have turned under tall maize, red clover, and weeds, so neatly that it was difficult to determine what kind of plants occupied the land previous to being ploughed.

THE DOUBLE STEEL PLOUGH.



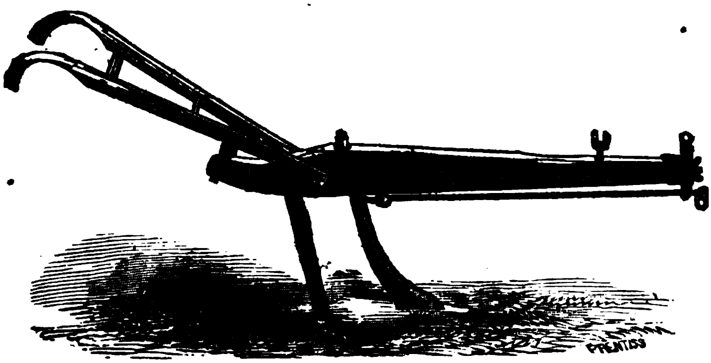
The illustration herewith given represents a steel plough similar to the far famed "Michigan sod and sub-soil plough," that has gained such a world-wide reputation.

This is manufactured by the Ames Plough Company, Boston, and also New York city. It needs little or no explanation. The figure of the plough gives the reader about as correct an idea of the implement as if he were to see the plough itself.

The question will doubtless be asked, why have two ploughs on one beam? Or, wherein consists the advantage of having a small plough in front of the large one? I answer, this plough is adapted to a peculiar kind of ploughing. When the stratum of mould which constitutes the soil is thin, and rests on a compact and cold sub-soil, this kind of plough should never be employed, as it will turn the mould which is needed at the surface, several inches beneath this cold unfertile ground. But when there is a deep soil of muck or vegetable matter resting on a clay, or clay loam soil, this kind of plough should be employed to bring up some of the heavy soil to mingle with the light soil.

SUB-SOIL PLOUGHS AND PLOUGHING.

There are several kinds of sub-soil ploughs; and certain ploughs that are more properly trench ploughs are designated as sub-soil ploughs. A sub-soil plough has no mouldboard nor land-side. The implement is properly a pulverizer.



The accompanying illustration represents a sub-soil plough, manufactured by Ames Plough Company, Boston, Massachusetts, which, I believe, has thus far given fair satisfaction. Another kind, manufactured by R. H. Allen & Co., 189 Water street, New York city, has a flange bolted to one side of the standard, which elevates the sub-soil much more than the kind represented by the illustration herewith given.

The sub-soil plough is drawn in the furrow made by the common plough. Its office is to break up the compact and impervious substratum of heavy soil, leaving it in the furrow where it is broken up. Sub-soil ploughs can be used advantageously and profitably only on those farms where the surface-soil is thin and the sub-soil exceedingly compact and not sufficiently fertile to admit of being thrown upon the surface. On many of the farms lying on the slopes of our northern lakes, where there is but a thin stratum of mould which should be kept on the surface, the sub-soil plough should be employed every season, as often as the land is ploughed, until the entire ground is pulverized for fifteen or twenty inches in depth. If a farmer has but a single team, he may work his sub-soil plough by cutting one furrow with the common plough, and then hitch his team to the sub-soil plough, and plough alternately around the land. This is a slow way to plough, but it is better to do so than not to pulverize the compact impervious soil. The most convenient and expeditious way is to employ one team to follow another, working a common plough first, and following with a sub-soil

plough in every furrow. Ground must be sub-soiled several times before the hard impervious substratum will be thoroughly pulverized.

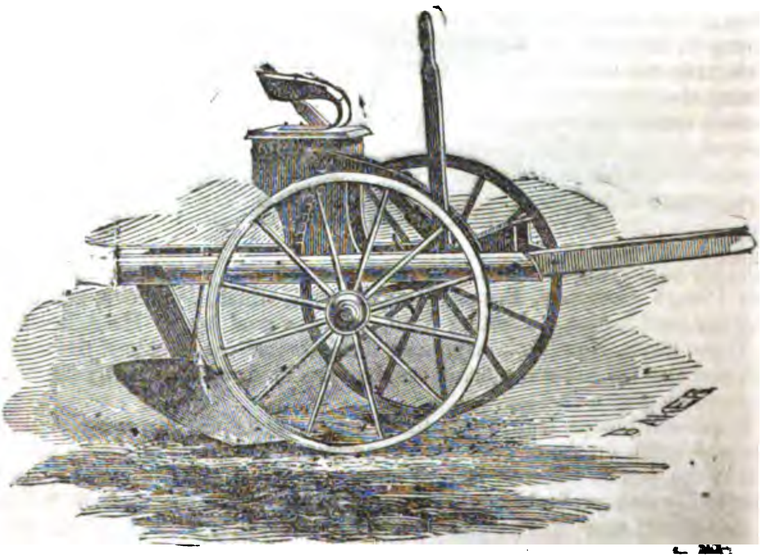
GILBERT'S COMBINED PLOUGH.

Mr. P. M. Gilbert, Kewanee, Illinois, has invented and put into successful and satisfactory operation a combined sub-soil and surface-soil plough. I failed to get a sketch of it. The invention consists simply of a sub-soil plough or pulverizer, attached to any common plough.

The advantage consists in this—one man can hold two ploughs when this attachment is in use, whereas, when the sub-soiler is separate from the surface-soil plough, two men are required. This sub-soil attachment costs but a few dollars, and has succeeded admirably wherever it has been introduced. So soon as American farmers perceive and appreciate the importance of sub-soiling such land as requires the use of the sub-soil plough, such a plough as Mr. Gilbert's will be required as well as the common plough. I have not been able to ascertain whether this style of plough is made further east than Illinois.

PFEIL'S GANG AND TRENCH PLOUGH.

The illustration herewith given represents a gang plough made by J. C. Pfeil, Arenzville, Cass county, Illinois, which is received with no little favor at the west. Almost incredible stories are told of its excellence and efficiency in ploughing the prairie fields of Illinois and other States.

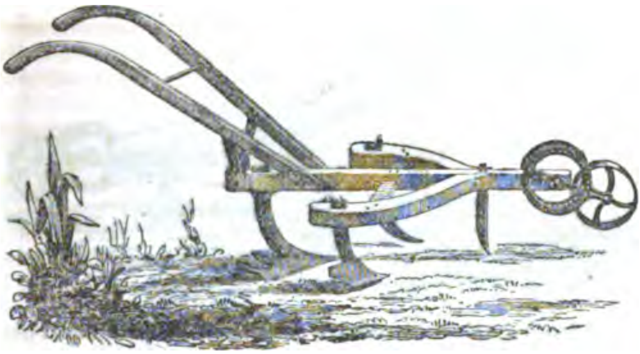


The depth of the furrow is regulated by the crank-axle, which is so arranged that the ploughs can be driven deeper or shallower, at the pleasure of the driver when the team is moving, by means of the lever. The proprietor states that this gang or sulky plough will cut a furrow from two to ten inches deep.

The illustration gives such a fine representation of the sulky plough that further description is deemed unnecessary. The committee who tested the draught of this plough with a dynamometer state, that it ran lighter by 140 pounds than other ploughs when running at the same depth and held by the ploughman while on foot.

KNOX'S HORSE HOE.

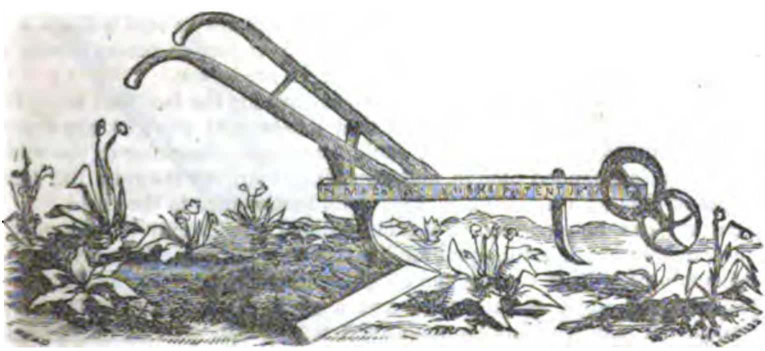
Although large numbers of this hoe have been in use for several years, the mass of small farmers do not know there is such a labor-saving implement in existence.



Arranged like the illustration herewith given, this hoe is designed for cultivating Indian corn, broom corn, sorghum, potatoes, and all kinds of root crops, the first time the rows are dressed out. It is a very light and effective implement. The front tooth operates as a coulter to dig up the soil, and to give steadiness to the implement when it is in use. The two side ploughs may be changed from side to side, for the purpose of turning the earth towards or away from the rows of growing plants. The broad rear tooth cuts up the grass and weeds most effectually, and pulverizes the surface of the soil. The prongs in the rear sift the dirt and weeds, leaving the surface of the ground level, and the grass and weeds exposed to the burning sun, where they soon wilt and die. Where the rows are too close together to admit this implement to pass freely between the plants the side ploughs can be removed.

KNOX'S COTTON HORSE HOE.

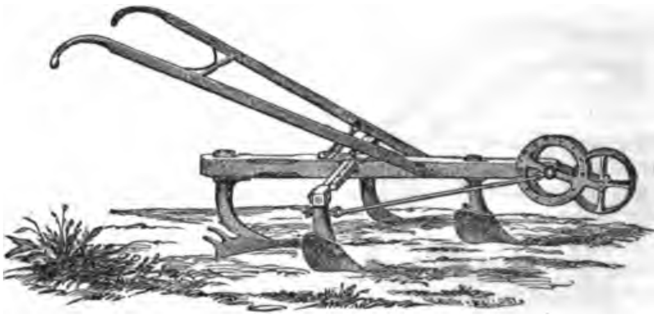
The horse hoe herewith represented is similar, in some respects, to the preceding implement. The broad steel tooth is designed more particularly for the cultivation of the young cotton plants, young carrots, and all other roots where



level cultivation is preferable to ridges or hills. It is so simple that further explanation seems quite unnecessary. Teeth of several different sizes are manufactured by the Ames Plough Company, Boston, Massachusetts, and 53 Beekman street, New York city. Farmers at a distance, therefore, can purchase the teeth, and if they choose can apply them to old implements as they are worn out or become useless.

HOWE'S EXPANDING CULTIVATOR.

The implement herewith represented is made by the Ames Plough Company, and is similar to Knox's horse hoe, previously mentioned.



The forward tooth of this cultivator is a small, double mouldboard plough, which throws up two ridges. Each of the side ploughs turns a furrow towards these ridges. The rear tooth digs up the soil beneath the ridges, and the prongs sift out the weeds and grass, leaving them on the surface.

The superior feature of this cultivator consists of the expanding bars, which enables the operator to place the side-ploughs three feet or less apart, for the purpose of stirring the entire surface where the rows are four feet apart. The implement is similar to the Knox hoe, and is manufactured by the same company.

LEFT-HANDED PLOUGHS.

With some excellent farmers, left-handed ploughs are in common use; and those farmers will not be induced to use ploughs that turn the furrow-slices to the right. In some counties in Pennsylvania, almost every farmer employs left-handed ploughs only, under the erroneous impression that the plough that turns the furrow-slice to the left instead of the right hand requires less force of the team to draw it. Of course, the near-side horse or ox must necessarily travel in the furrow, where a left-handed plough is employed instead of a right-handed implement. In those localities where the left-handed ploughs are used in preference to those that turn the furrow-slices to the right, teams of horses are driven, for the most part, with a single line; and double lines for driving teams are as rare a sight in those localities where the left-handed ploughs are in vogue, as teams driven with a single line where none but right-handed ploughs are in use.

I should not have alluded to this subject, but for the fact that some farmers and agricultural writers have insisted that left-handed ploughs are superior to right-handed ploughs; and that they could commence ploughing in the middle of a field with a left-handed plough, and turn all the furrows inward; but that they could *not* do this with a plough that turns its furrow-slice to the right.

Whatever can be ploughed with a left-handed plough may be ploughed with a right-handed plough, with equal facility in every respect. One will require no more force to draw it, if constructed of the same form, than the other; one will do just as good work as the other, and no better, nor worse, so far as *force* is concerned. A man who has always used a left-handed plough only, might experience difficulty in holding a right-handed plough, until after he has had several days' practice with that kind of implement.

In this connection it is proper for me to mention that the share or point of a right-handed plough is always bolted on with a left-handed screw, while the bolt that holds the point on a left-handed plough is a right-handed screw. Every plough-boy knows this to be a fact; and he can give a philosophical reason why it should be so. But I have met with editors of agricultural papers who were utterly

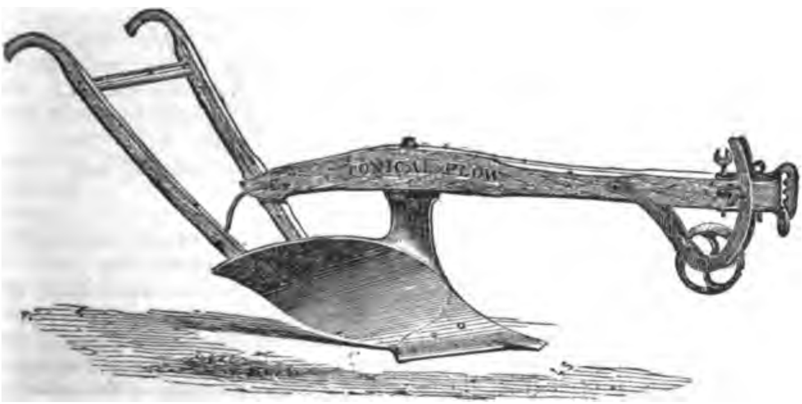
ignorant of this fact until it was pointed out to them. I record these things not for practical farmers, for they are already familiar with them, but for beginners who are leaving the city and commencing farm operations, and who have almost everything yet to learn.

SPINK'S ANTI-CLOGGING COULTER.

The illustration herewith given represents a new and eminently useful coulter to prevent clogging when ploughing stubble ground, or when turning under coarse manure or clover. It can be readily attached to the beam of almost any plough with the same fastening that is required to secure an ordinary coulter in the desired position. The shank of the coulter should stand perpendicularly on the beam of the plough, as represented by the illustration. The upper part of the blade is made as represented by the figure, with the upper point bending over to the left three or four inches from a line with the shank. As the stubble or coarse manure is forced up along the edge of the blade, it is conveyed to the left of the shank and falls off the point of the blade instead of being gathered beneath the beam to clog the plough.

Any ingenious blacksmith, with this illustration before him, will be able to make such a coulter with little difficulty. This device was invented by M. A. Spink, Rensselaer Falls, New York. It has not come into general use, as very few farmers know anything of its merits, and a small proportion only have seen such a device.

MEAD'S CONICAL PLOUGH.



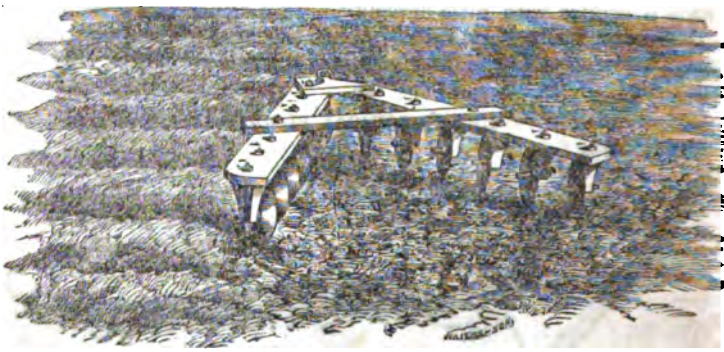
R. H. Allen, 789 Water street, New York city, has an improved plough of great excellence, denominated the "Cylinder Plough," because the mouldboard is made of a curvature to fit a perfect cylinder. The plough herewith represented received its name from the mathematical principles on which the mouldboard is constructed. The concavity of the mouldboard, instead of being made to correspond to the surface of a cylinder, is constructed to coincide with the surface of a cone, with

the large end of the cone to the front part of the plough, which is the means of giving an easy separation of the furrow-slices, as they are cut loose and turned over. By this peculiar form of the mouldboard the furrow-slices are more thoroughly pulverized than when the board is made to fit the straight surface of a cylinder.

When the furrow-slice rises on the mouldboard, the tendency is to pulverize and separate one side of the furrow-slice more than the other. This operation can be perceived when ploughing stubble ground. In this conical mouldboard the adjustment and distribution for overcoming the friction of raising and turning a furrow is very evenly balanced. I went from New York city to New Haven expressly to test one of these ploughs with my own hands. After adjusting it to run as I desired to have it, I walked behind it as it ploughed eight times in succession around the land, without any one's touching the handles, except at the ends when the team was turning around; and even then it was not necessary for me to take hold of the handles, as the plough would have kept erect when ploughing across the ends. That test proved conclusively that this plough, manufactured by Solomon Mead, New Haven, Connecticut, is about as evenly balanced as a plough can be. The draught is much lighter than most other ploughs, which is proved by the peculiar form of the share, the wing of which is uncommonly broad and lies as flat as is practicable to make it. This position and shape of the cutting edge of the share enters the ground much more easily than when the wing of the ploughshare does not lie so flatly.

This plough is adapted to all kinds of ploughing, and I know of no other plough that will excel it for turning sod or stubble of all kinds. Mr. Mead manufactures several sizes of this improved plough, and also an excellent side-hill plough, the mouldboards of which are constructed on the conical principle.

NISHWITZ'S HARROW

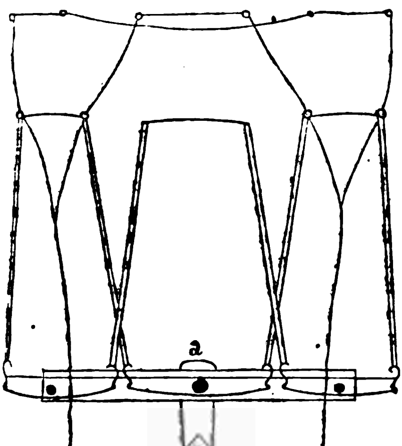


The accompanying illustration represents a new style of pulverizer, invented by F. Nishwitz, 142 First street, Williamsburg, Long island, New York. The principle of construction is quite new, but, by those who have used it, the operation is said to be eminently effective. The wooden frame consists of two pieces of hard, tough timber, about two inches in thickness by seven or eight inches wide, held in position by the cross-bar, which is firmly bolted to the side pieces, as represented by the illustration. By taking out the bolts which secure the cross-bar, the wings can be spread further apart or brought nearer together.

The pulverizers consist of several sharp-edged circular disks, about one foot in diameter, being concave on one side and convex on the other. When the wheels, or disks, are cast, a round steel pin, about three-fourths of an inch in diameter, is inserted in the mould, thus furnishing a steel journal for each disk. A bolt with a nut at the upper end is passed through a socket-standard, which holds the disks in their position.

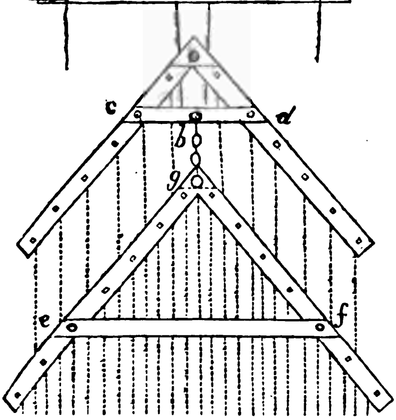
When the pulverizer is in use the disks are set at any desired angle to the line of draught, and each disk thus pulverizes and turns over a narrow furrow-slice. The disks operate by cutting, lifting, and turning over a few inches in depth of the entire surface of the land. Wherever it has been thoroughly tested, I believe the implement has given excellent satisfaction.

In manufacturing this kind of implements it is eminently important that the clasp or loop in which the steel pins turn or work should be at least two inches broad. If they are made narrow the friction is so intense that either the gudgeon or the box will be cut out in a short period. This kind of pulverizer will evidently leave the surface of the land much lighter than the ordinary harrow, as the disks cut their way through the soil and lift it up without compressing a portion of it, as is done by common harrow teeth. There ought to be a bearing on both sides of the disk, instead of being all on one side. If the steel were to extend entirely through the hub of the disk and were supported by two boxes instead of one, the steel pins would wear much longer, and would run more easily than when the discs are supported by the bearing on only one side of the disk.



HICKS'S TRIANGULAR HARROW.

Edward Hicks, North Hempstead, Long Island, has furnished the accompanying description of a triangular harrow, which can be made in a new country, when a farmer has but little to do and has no money to expend for an expensive harrow.



The illustration shows the three-horse whiffletree bolted to the forward end of the stem-piece of the front part of the harrow, and the manner of hitching the traces of each horse or mule is clearly represented by the lines which indicate the traces. The guiding reins or lines are shown as they are employed when three horses are used. The heads of the horses are coupled together with small ropes or straps. Everything is so very plain that further explanation is not required. The timber of which such a harrow is made should be about three inches square, and be tough and hard.

CHEAP LAND-ROLLERS.

For certain kinds of work there is no farm implement of greater efficiency in pulverizing the soil than a good roller. On some farms, where the soil is heavy and disposed to be cloddy, a good roller is indispensable to thorough cultivation; but where the soil is light, always dry, and never lumpy, a roller is of little value.

Most farmers want a cheap roller. Few men feel willing to pay $25 to $40 for a roller. Farmers who have limited means and a small farm cannot afford to purchase a land-roller at such an expensive rate. A cheap, plain log roller is objectionable, because it is hard to turn around, as the team must slide one end around by main force; this is particularly objectionable when rolling young grain or grass, as the end, in sweeping around will shove the mellow earth up in a ridge.

A cheap and excellent roller may be made, by an ordinary mechanic, at a small expense. Select a log about three feet in diameter, or a smaller log will subserve a good purpose. Saw it into cuts one foot long. Let the saw be put in good order, so that the cuts may be sawed off true. Find the centre, with a compass, and dress off the periphery, so as to make a round block wheel. Eight such block wheels, having an inch and a half hole bored through the centre of each, strung on a round iron bar, with a wooden washer between the wheels, will make as cheap and convenient roller as any farmer can desire. Every wheel will revolve independently of the other. The spindle or journal should be entirely straight, the rough places filed off smoothly, and the bearings at the ends of the bar be either turned round or filed as nearly round and true as may be practicable.

When boring the holes through the centre it will be necessary to make a stay, like a four legged stool, to hold the auger when boring at a right angle to the side of the wheel.

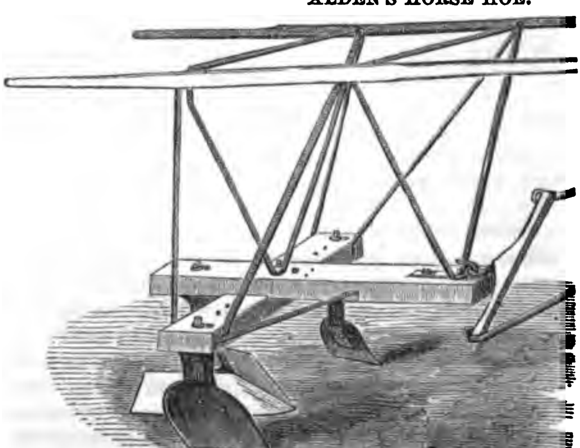
Some kinds of timber, when dressed out in block wheels, will crack badly. Therefore, to avoid large cracks, the timber ought to season one year, under shelter, with the bark on. Then there will be no cracks to injure the block wheels. Such a roller may be made of white wood, oak, white elm, or sycamore wood; the latter kind of wood is much less liable to crack badly than timber that will split freely.

The size of a roller has been alluded to frequently by agricultural writers, and in some instances small rollers have been recommended as far superior to those of a large diameter, as the small ones would crush more clods than a large one.

I have made rollers of both kinds, and have used them extensively, and my experience warrants the statement that the best roller that I ever met with was made with my own hands. It was in two sections, made of plank, was four feet in diameter, eight feet long, and would draw much easier and crush more lumps of earth than a smaller one.

The best time to roll land is a consideration of much importance. The object is to mash the hard lumps. If the ground be rolled when they are hard and dry, many of them will be pressed into the mellow earth without being pulverized. But soon after a shower all the hard lumps will fall to atoms with a slight pressure. This is the best time of all others to speed the roller, as it will do thorough work. Let it be borne in mind that a good roller for some land is quite as important as the plough, and more so than the harrow. But land should not be rolled when the surface is too wet.

ALDEN'S HORSE HOE.



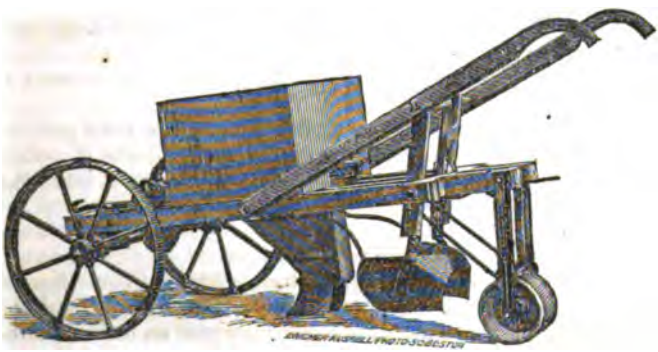
The illustration accompanying this subject represents a horse hoe guided by thills, which has recently been improved by M. Alden & Co., Auburn, New York. The machine is an excellent labor-saving implement, as I know from practical experience, having used one of them on my own farm. On stony ground, the teeth of this hoe being broader and more flat on the bottom than some other horse hoes, it will not enter the soil as quickly as those

teeth that stand at a more acute angle. This horse hoe can be employed for dressing out all kinds of hoed crops; and those who have used it among young cotton plants state that there is no horse hoe now in the market that can excel this implement for facility of handling and efficiency of operation in dressing out the young cotton plants. The large steel tooth may be attached to the frame either forward or in the rear; and the side teeth may be detached or changed to any desired angle, or set to throw the soil towards or away from the growing plants. I have met with no other horse hoe that is constructed to perform so great a variety of operations as this. By removing all the teeth and attaching a broad-winged steel tooth, one horse will hill or "earth up" more celery than can be done by twenty laborers with hand hoes. The teeth are removed from the frame and a marker attachment is boltedto it, for marking out the ground for any kind of crops. A pronged tooth is bolted to the frame, in the place of the cultivator tooth, and the implement is then changed into a potato digger.

The thills enable the operator to manage this hoe with far more dexterity and skill than if the implement were drawn simply by the traces; and when turning the horse around at the ends of the rows, he can be guided so as to break down much less corn than if there were no thills. The braces that are bolted to the thills are so arranged that the teeth can be set to enter the ground more easily, or the pitch of the teeth may be only enough to cause them to enter the ground one or two inches.

TRUE'S POTATO PLANTER.

The illustration accompanying this article represents a potato planter, invented by Mr. J. L. True, Garland, Maine, which is drawn by one or two horses, and guided by one man by means of handles, similar to the management of a plough.



The machine is supported on two drive wheels, similar to the driving wheels of a mowing machine. The driving wheels work the dropping and cutting apparatus. In the bottom of the hopper which contains the potatoes to be planted there is a sink on each side of a slide, which is worked back and forth by means of a crank or pitman. One or more potatoes drop down into the recess, when the slide forces the potato against a knife, which cuts off all that extends below the knife. After it is cut off, the piece, or pieces, drop down into the furrow that is opened to receive the seed. The furrow is opened by a small, double mould-board plough, and the seed drops directly behind it, before the mellow soil, or clods or sods, have time to roll down into the furrow. A scraper of peculiar form follows the plough, which fills the furrow with mellow soil, covering the potatoes as neatly as it can be done by hand. Immediately in the rear of every other part of the planter there is a cast-iron roller, which rolls every row. The drive wheels make marks sufficiently distinct, where the land is well prepared, for a guide, when returning, to enable the operator to plant the rows the desired distance apart.

The seed is dropped in hills forming rows only one way. The seed may be dropped at any desired distance apart, by means of pinions of different sizes, which increase or diminish the reciprocating motion of the slide in the bottom of the hopper.

I have been familiar with this planter for several years; have worked it when planting potatoes, and I am satisfied that it is a great labor-saving machine.

SPAULDING'S POTATO PLANTER.

As I was about finishing this chapter, I was invited to see a potato planter which was being made by Edward Spaulding, 189 Water street, New York city, which promises to perform satisfactorily the operation of planting potatoes that have been cut up into sets. I shall merely record a partial description of it, as it was not completed at the time of inspection. Still, it is a matter of interest to know that such a great labor-saving machine is about to be offered to the farmers of our country.

In order to furnish an idea of its operation, I will simply state that a plough, similar to the one attached to Mr. True's planter, which is illustrated on a preceding page, opens a furrow, a distributing apparatus drops the potatoes, and a coverer hauls the soil over them. The pieces of potatoes, or the sets, are deposited in a box, on one side of which there is a system of revolving spears, operated by machinery, each of which is thrust down into a piece of potato, and carries it around to the point where it is to be slipped off the spear and dropped into the drill.

Judging from an examination of some of the parts of this planter, there appears to be nothing to prevent it, when completed, from proving a success. Should this machine not succeed satisfactorily, there is reason to believe that a similar planter will eventually be brought out, that will drop potatoes after they have been cut as accurately as it can be done by hand.

POTATO DIGGERS.

Several small fortunes have been expended within a few years past in securing letters-patent for, and manufacturing, potato diggers. Scores of potato diggers have been invented, patented, manufactured to a limited extent, and sold to farmers with the assurance that the machines would perform in the most satisfactory manner all that is required of a digger, or no money would be demanded of the purchaser. It is said that patents have been issued at the Patent Office on nearly two hundred devices for digging potatoes. And yet American farmers are chagrined at the thought that among the long array of these implements they cannot point to one that is, to all intents and purposes, an implement possessing efficiency to warrant its manufacture, unless the diggers hereafter illustrated and noticed shall prove to be the implements desired.

Digging potatoes is a peculiar operation. Inventors of horse-diggers have not appeared to fully understand what is really required in a successful digger. They have not fully understood the principles of mechanics, the science of force and motion, of friction and resistance, the correct velocity and shape of the working parts of a machine for digging potatoes, and the immense amount of labor required to plough up, dig over, and thoroughly pulverize a strip of soil one foot or more wide and half a foot in depth, and at last leave the potatoes on the surface of the ground.

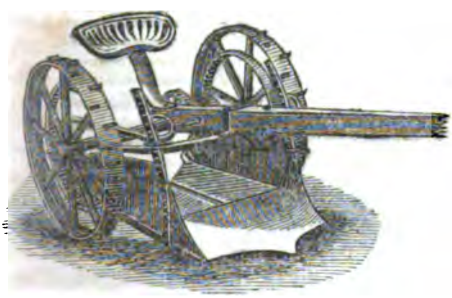
Every practical farmer understands how much force is required to simply break up a furrow slice, one foot in width and six inches deep. But a potato digger, in order to operate satisfactorily, must break up the soil, pulverize it most thoroughly, and separate the potatoes from the loose dirt. To perform such an operation as fast as a team will ordinarily move, requires the combined force of at least four or five strong horses.

The chief difficulty with all the diggers has been the imperfect manner of separating the potatoes from the dirt. The digging apparatus—the plough part—of a great many machines appeared to operate in the most satisfactory manner, but the separating apparatus failed. The potatoes would be covered up in the dirt. The consequence was that there were more than enough potatoes left buried in the loose earth than would pay a laborer for digging the crop by hand. Much more force is required to elevate the earth and the potatoes than inexperienced men usually suppose. Consequently, in calculating the dimensions of the different parts of the plough and the separator, almost every inventor has failed to construct his digger so as to bring the earth and potatoes so high above the surface of the ground that there might be sufficient space beneath the separator for the loose dirt to pass through freely. For example, we will suppose that the plough runs beneath five inches in depth of earth; therefore, in order to give sufficient room under the shaker for the loose earth to drop through readily, the under side of it must be not less than six inches from the ground.

But instead of this arrangement, the shaker, or separator, works so closely to the ground that not half the dirt can pass between the bars of the separator before the shaker rests on the ground, thus effectually preventing the passage of dirt through the shaker. Therefore, potatoes, dirt, and all must pass off the rear end of the separator; and many of the potatoes would be covered up in the earth.

In the season of 1865, Rev. J. J. Hill, Xenia, Ohio, invented a potato digger that was thought to be a triumphant success. R. H. Allen, 189 Water street, New York city, manufactured a number of them; but the machine failed to give satisfaction, as it would not separate the potato from the dirt. The machine would dig the potatoes perfectly clean; but a large number of them would be covered up in the dirt. The separator consisted of a system of forks which revolved in the opposite direction of the two drive wheels, and the tines came up between the iron prongs in the rear of the scoop-plough and lifted the potatoes, tops and all, from the prongs, and threw them in the rear of the machine.

ASPINWALL'S POTATO DIGGER.



The illustration here given represents a potato digger that is said to work satisfactorily, but I have not had an opportunity of seeing it operate. It is manufactured by Wheeler, Melick & Co., Albany, New York. Those who have seen it dig potatoes state that it performs the work perfectly, and faster than it can be done by twenty men with hand tools. The manufacturers assure me that it digs the potatoes satisfactorily, without pulling the vines. The machine is drawn by two horses abreast. The working parts are supported on two drive wheels, similar to the wheels of a mowing-machine. A shovel-plough made of plate steel is suspended by iron bars, so as to run at any desired depth below the potatoes. By the forward movement of the machine, the earth and potato tops are forced back upon the double-vibrating separator, which shakes the dirt down through the bars and delivers the potatoes on the surface of the ground, in the rear of the machine. The bars of the separator are made of steel; and the manufacturers state that it will dig well even in heavy soils and where the land is rough. The illustration furnishes a fair idea of the digger, so that a more minute description is not necessary.

CONOVER'S EMPIRE POTATO DIGGER.

The illustration herewith presented represents a two-horse potato digger, invented by S. B. Conover, 260 West Washington Market, New York city, who has been experimenting for many years with potato diggers, and has spent a vast deal of time and money to obtain a successful machine. He feels assured that this machine is a complete success. A small number only has been manufactured; and thus far they subserve an excellent purpose. The inventor states that the machine performs the work of digging and separating potatoes thoroughly and efficiently.

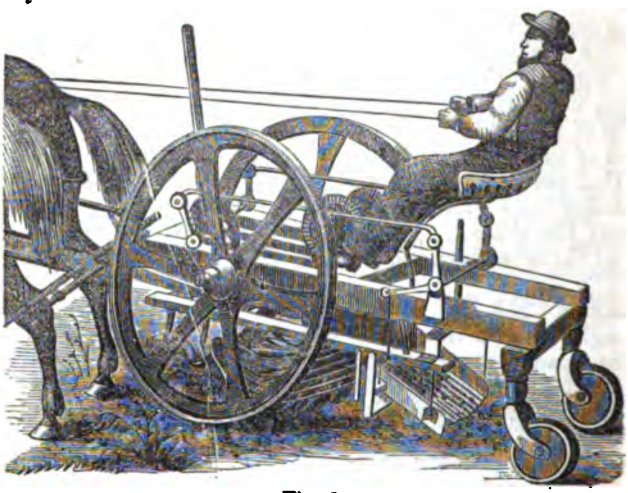


Fig. 1.

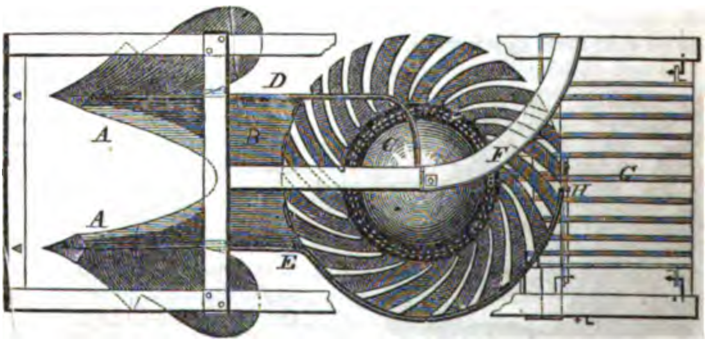


Fig. 2.

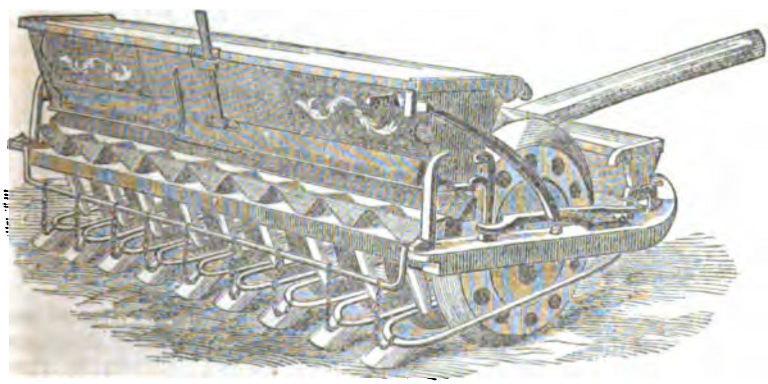
The inventor thus describes the digger with the aid of the lettered section, figure 2. It consists of a main frame mounted on an axle and driving wheel which give motion to the carrying wheel C, and screen G, with caster-wheels in the rear, and which are merely to steady said main frame, and allow the use of a loose pole so as to avoid any weight on the neck of the horses. On the axle is hung the cog wheel which gives motion to the pinion which is hung on the counter-shaft, on which is also the bevel wheel which gives motion to bevel pinion, which gives motion to the wheel that shakes the screen G. The supplemental frame is hung beneath the main frame, and is connected with the main frame by rods secured to the bell-crank levers placed on the main frame, and held in position, or elevated and lowered to any required depth by the lever and socket connected.

To main frame on supplemental frame is fastened the double-pointed plough A A, which goes under and takes up the middle of the rows or hills, fifteen inches wide, which, as it passes back, is taken on the carrying wheel C, which being open, lets some of the dirt through and carries the remainder back, dirt, potatoes, and vines, to shaking screen G, by which means the dirt is thoroughly cleaned from the potatoes, and the potatoes and vines are conveyed to the back end of the screen clean, and dropped on the surface of the ground. In front of the plough A A there are placed two coulters, one directly in front of each point of the plough, and fastened on supplemental frame, which catches and turns the vines and weeds in the row so that they will pass over the plough, and thereby prevent them from clogging or catching on the standards or sides of the plough. There are also attached to each, outside of the plough, shares which throw the dirt from the sides of the row. This dirt does not pass over the plough, but is thrown in the furrow out of the way of the machine. The machine is in every way under the control of the driver, whose seat is on the main frame. In trials made with this digger, the past season, it performed its task in a complete manner, taking out all the potatoes, delivering them clean on the surface of the soil, which is left level and thoroughly pulverized.

D and E represent screen guards extending around a portion of the wheel C, for preventing the potatoes and earth being thrown off the wheel until everything is brought around to the separator G. At F, is a vertical plate of steel operating as a scraper for removing the earth that may adhere to the surface. Projecting downward from the supplementary frame, over and beyond the points of the shovel plough, are two deflecting arms or coulters, the office of which is to turn or deflect inward the potato tops or vines, so that they will pass over the central part of the shovel plough to the carrying wheel without clogging the action of the machine.

BECKWITH'S ROLLER DRILL.

One of the best farm implements of modern invention is represented by the accompanying engraving of Beckwith's Roller Drill, which is constructed for



planting grain of a more uniform depth than with some tube drills. It is constructed according to the most correct philosophical and mechanical principles; and every scientific farmer will at once acknowledge that this kind of drill puts in the grain on the most correct principles. This drill consists of a series of nine cast-iron rollers or wheels placed on a wrought-iron shaft or axle, which will roll on the ground and support the frame and machinery of the drill. These rollers are 28 inches in diameter, and have a V-shaped periphery, which, by the aid of

the weight of the frame and other parts of the drill, will press small furrows in the earth to receive the seed. These rollers are made with sufficient hub to keep them the proper distance apart, seven and a half inches from centre to centre; and each one is loose on the axle and has an independent movement from each other, except the centre roller and one at the end, which are both made fast *on* and rotate *with* the axle. This end roller drives the distributing apparatus; and by the aid of the centre wheel, will make a uniform motion for distributing the seed regularly upon the most uneven ground. The frame of the drill is made of two cast-iron slide-pieces, with rounded corners in front, so as to ward off stumps and other obstructions, when passing them, and still be able to drive the machine very close to the same so as to sow all the ground that can be *ploughed* in new fields or among corn shocks, as many of our western farmers sow wheat after corn, the same fall, before the corn is removed from the field.

The box or hopper for holding coarse grain is placed behind the rollers, and is made in the usual form, and has two iron plates or jaws at the bottom, one made fast and the other movable. There is a wooden rod placed under these plates, with wire pins projecting up between and about one-half an inch above the plates into the seed. This rod is made to vibrate by suitable lever connections, a cam on the end, with roller. The wire pins running between the plates of the hopper upward into the seed will agitate and cause it to run out between the opening, which can be regulated to sow the desired quantity. The seed from the distributer is conducted down through iron pipes into the *furrows* made by the rollers. There are inverted iron hoes, or coverers, attached to the frame and drag behind the rollers and conducting pipes, to cover the seed. These coverers can be raised from the ground, when turning around, by means of a crank attached to the journal. The grass-seed hopper is placed forward of the rollers and deposits the seed broadcast. The distributer is a slide of thin flat iron, placed in the bottom of the hopper with suitable holes in it to correspond with the openings in the bottom of the hopper to regulate the quantity sowed. The seed is agitated and made to pass through these openings by a serrated rod made to vibrate in the bottom of the hopper on the thin iron slide by being attached to the levers on the cam of the end roller.

These rollers all being on the one axle, will level the ground similar to a field-roller, and leave the surface in good condition for the reaper and mower; and the rollers being loose on the shaft or axle, may be turned around easily by the team.

I think that the grass-seed distributor should be placed behind the rollers, as they will cover the grass seed too deep. Grass seed of all kinds requires but little covering. My long experience assures me that a larger proportion of grass seed and clover seed will grow when sowed *after* the last implement has been drawn over the surface than when the seed is harrowed, rolled, or brushed in. There is great danger of covering grass seed too deep. The first shower of rain that falls on the field after the seed has been sown, will cover almost every seed as deep as is requisite to insure germination and luxuriant vegetation.

Another improvement in this excellent drill, besides placing the grass-seed distributor *behind* the rollers, is forming the V-shaped ridge on the surface of a broad thin rim, say five inches wide. This style of rollers would leave the surface of the ground more even, as all the clods would be crushed when they are more than one inch in diameter. If the periphery of the rollers were of this form, the channels made by the V-shaped ridges would all be of a uniform depth; whereas, when constructed of the present form, were the soil very mellow and light, the channels would be made too deep.

The eminent superiority of this drill over the tube drills is appreciated by those farmers who have had considerable experience in growing winter wheat, or winter barley or rye. As this roller drill deposits the kernels of grain about

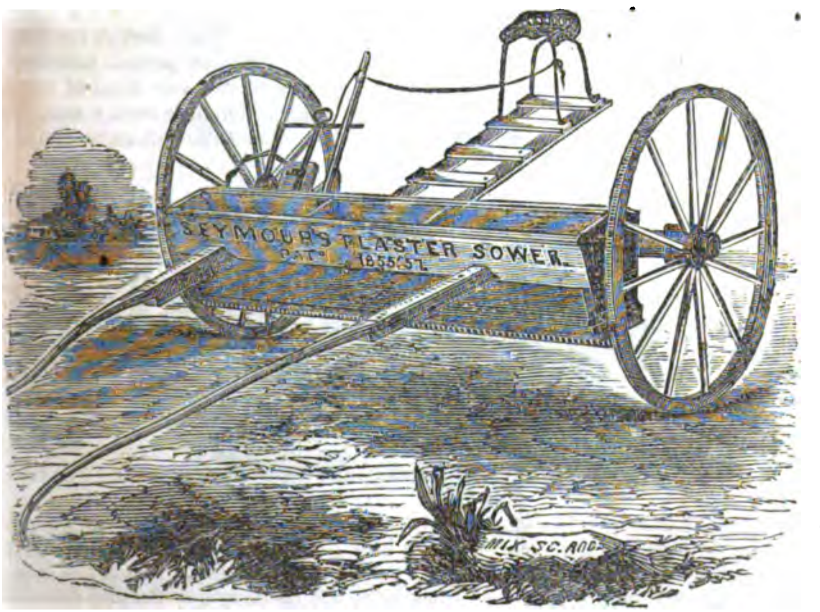
one and a half or two inches deep, the roots of the growing plants spread out nearly in a horizontal direction, more in a mass, and thus withstand more effectually the influences of freezing and thawing of the soil, and the consequent upheaving of the plants in the winter.

MACHINES FOR SOWING FERTILIZERS.

Sowing plaster or gypsum, lime, wood-ashes, or any kind of commercial fertilizers, is exceedingly disagreeable drudgery. Every farmer and farmer's boy, from the lowest laborer to the superintending proprietor, dreads the unpleasant and offensive task of scattering any of the above-named fertilizers by hand. Besides all this, laborers soon become so disheartened at such offensive employment that they will not do their work half so well as such labor should be performed.

Ashes and lime will shortly eat through the skins of their hands. Gypsum will fly in one's face, mouth, nose, ears, and hair, in such profusion that a laborer soon becomes so disgusted, that he fails to exercise proper care to scatter the material evenly. For this reason fertilizing matter is distributed very unevenly over the surface of the land if sowed by hand, and some portions of the field receive none at all. Furthermore, sowing such substances is exceedingly laborious and fatiguing.

To relieve the farmer of this expensive drudgery, P. & C. H. Seymour, East Bloomfield, New York, have invented a plaster sower, represented by the accompanying illustration, which is a fair representation of the sower in running order.



Gypsum, lime, or wet ashes may be deposited in the hopper and distributed with the most desirable accuracy. The proprietors inform me that this machine will sow damp ashes as well as when they are dry. Lumps of charcoal and all hard lumps of dry lime, or similar substances, which can be crushed by the light iron stirrers on the inside of the hopper, will not obstruct the perfect operation of the sower. The same machine will sow guano and bone dust of any kind in

the most complete manner. This kind of machine has been in use for several years past, and the proprietors assure me that not one of them has failed to give the most perfect satisfaction.

As immense quantities of gypsum, lime, ashes, and commercial fertilizers are spread broadcast annually, such a machine is of great value, as a lame man or boy can perform heavy labor with great rapidity by means of such a machine, who without it would be able to do nothing at all.

Several neighbors could own such an implement jointly, which with proper care would do all their sowing for a lifetime.

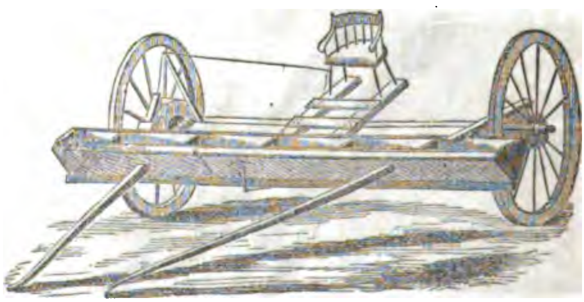
Besides this valuable farm implement, Paschall Morris, 1120 Market street, Philadelphia, Pennsylvania, and E. Whitman & Son, Baltimore, Maryland, manufacture Cooper's lime spreader, which is said to give eminent satisfaction in scattering lime and gypsum.

I allude to these things for the two-fold purpose of showing that farmers are becoming more and more interested in the great subject of fertilizing the soil, as well as in making their horses perform the drudgery of the farm.

Messrs. Seymour state that for ten dollars more they attach a grass-seed sower to this plaster sower, which scatters clover seed and grass seed with remarkable uniformity. As it is of the utmost importance to scatter grass seed evenly, and as few of the laborers of the present day are capable of sowing grass seed all over the ground by hand, such an implement is of great value.

SEYMOUR'S BROADCAST SOWER.

The illustration following this paragraph represents a broadcast grain sower, made by P. & C. H. Seymour, East Bloomfield, New York. As a broadcast sower, this implement has no rival in the country. Some farmers will not have a drill on their farms. All their seed grain must be sowed broadcast. Therefore, as very few of our laborers can be trusted to sow any kind of cereal grain, an intelligent farmer knows that it is economy to purchase such a machine, as his fields, if the seed be scattered evenly, will produce sufficient extra grain to pay for the sower.



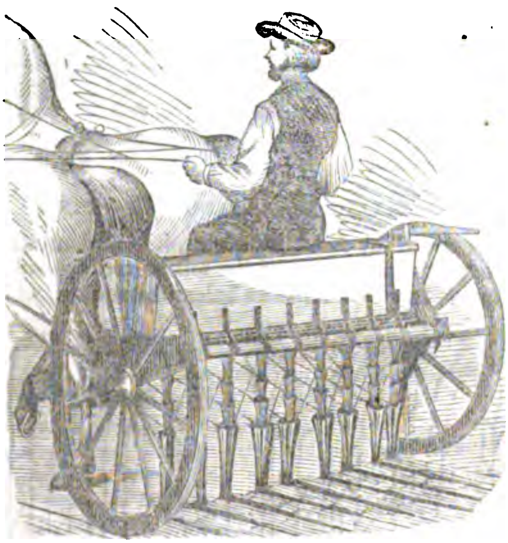
The manufacturers state that this sower is capable of dusting every inch of ground on an acre of land with less than half a bushel of plaster, and thirty or forty bushels of lime may be thus evenly applied to the same amount of land. It sows a breadth of ten feet. It sows correctly (and in any desired quantity per acre) all the various kinds of grain and seed commonly sown by farmers, from peas to the smallest seeds, (clover and timothy *mixed* if desired,) and all fertilizers or manures of a dusty nature, which are so nearly reduced to a powder that the largest particles will pass through an aperture which will let through peas or corn, or which, having once been ground or made fine, and become lumpy by exposure, (as plaster frequently does,) can readily be reduced again to powder, by the action of the "plaster rod," which is a kind of course sheet-iron saw,

used in the machine for distributing all such manures. The distributing apparatus is regulated by opening or closing a crack in the bottom of the hopper, by means of a lever.

Each has an aperture extending through the entire length of the bottom of the box. The bottom of the box of each consists of two iron plates, the edges of which are so accurately jointed as to form a complete joint, and are so applied and fixed to the bottom of the box, that when the aperture between them is enlarged or contracted, they retain their *parallel position.* They are also provided with fixtures by which the aperture between them may be enlarged or diminished in an instant, to any size required, and there firmly secured. The fertilizers are forced through the bottom of the plaster sower by a series of knives or iron blades throughout the entire length of the box. Each of these knives is hung on a pivot in the upper part of the box and passes down through the bottom, and pivoted to an iron rod or bar having a vibrating motion.

By this motion of the knives they naturally distribute the fertilizers in the most perfect manner. The grain, seed, and fertilizers in the broadcast sower are distributed by points or pieces of thin iron, rigidly fixed to a rod or bar under the box, and which pass up through the aperture into the grain. A vibratory motion of this rod does the work. There are three of these rods with the points (or teeth, as they are usually called) of each differing from the others, and each adapted to its particular use—one for grain, one for plaster, and one for grass seed.

A fourth is added for flax seed when required.



I cannot forbear to say something in favor of tube drills. A great many kinds have been abandoned because they did not do the work satisfactorily. There are tube drills that will put in seed in a most excellent manner, where the roller drill would fail entirely. Tube drills will put in grain as well as practicable among stones, clods, and sods, where a roller drill would ride on the tops of such obstructions. Where the surface of the land is very uneven, abounding in ridges and knolls, a good tube drill will put in the seed more evenly than it can be done by any other machine. Still many good farmers think the roller drill is adapted to a more perfect condition of agriculture than the tube drill. The intelligent reader will understand the difference which I desire to allude to between the two kinds of implements.

The most perfect and reliable tube drill that is made in America is manufactured by H. L. & C. P. Brown, Shortsville, Ontario county, New York. Perhaps there are other drills made in Chicago, Illinois, and by E. Whitman & Son, Baltimore, Maryland, which will compare favorably with the "Brown drill;" but none that has yet been invented can excel this valuable farm implement. It will sow all kinds of cereal grain with the greatest accuracy, and it will plant peas and beans equal to any seed planter.

The accompanying illustration represents the distributing apparatus, which is a very ingenious and efficient arrangement for distributing seed by means of wheels revolving within a cast-iron case. The projections on the periphery turn out the grain with desirable uniformity.

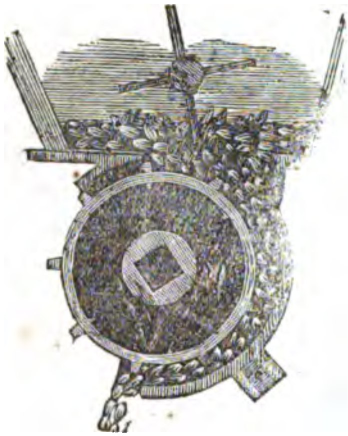


Fig. 1. Wheat run.

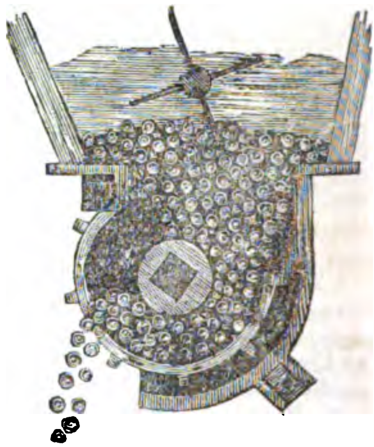


Fig. 2. Pea run.

DRILLING VS. BROADCAST SEEDING.

When grain is sowed by hand, broadcast, it is seldom scattered evenly, and when the team harrows in the seed, if the soil be mellow and deep, much of the seed will be passed five or six inches below the surface, while a portion of the

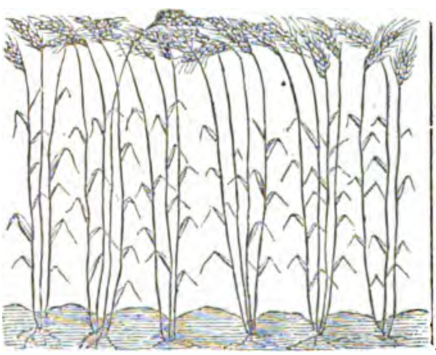


Fig. 1.

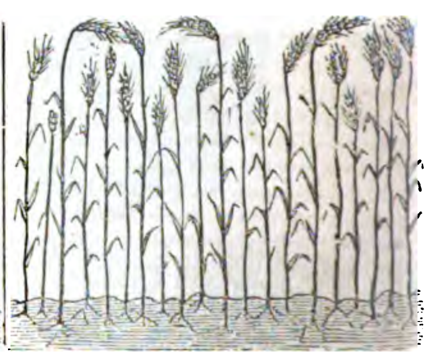


Fig. 2.

seed is barely covered with earth. When the grain has matured the height of the stalks and size of the ears will be as irregular and disproportionate as the illustration herewith given at the right hand; but when sowed with a good drill, being distributed evenly and regularly, at a sufficient and uniform depth in the soil to receive the moisture, it all germinates at once, and comes up

healthy and strong. When sowed broadcast and harrowed a portion of the seed is left uncovered, exposed to the drying winds and scorching sun, to the fowls and birds, and that which is covered is at very unequal depths, some very deep, some medium depth, and some so near the surface that in case of drought it fails to mature for lack of moisture.

Moreover, when seed is deposited at a proper depth in gutters with a ridge of earth on each side, the growing plants are protected, in a measure, as these ridges are gradually washed down around the plants, which is not the case when the seed is scattered broadcast.

It is estimated, by some of our most successful farmers, that by the use of the grain drill they save from half a bushel to a bushel of grain per acre, and the yield per acre is several bushels greater than when the seed is scattered broadcast by hand.

Manufacturers of tube drills have experienced great difficulty in making an apparatus that would not clog when sowing any kind of grain. The distributing apparatus was so constructed that the seed would be tumbled out three times as thick in some places as it should be, and not half enough in other places. A great many grain drills, *claiming* to be perfect in this respect, have been thrown aside as utterly worthless; but Brown's tube drill is so constructed that the grain must come out just so fast, and no faster; and I have never heard a farmer raise a single objection to it.

SEED PLANTERS.

There are numerous machines for planting Indian corn, beans, peas, cotton seed, and almost all kinds of vegetable seeds that are grown in rows or drills. At most agricultural warehouses hand planters, costing three or four dollars each, can be obtained. These small planters are adapted to distributing only the seeds of carrots, beets, turnips, parsnips, &c. R. & H. Harder, Cobleskill, New York, make an excellent seed planter for putting in all kinds of seeds. At the Albany Agricultural Works, Albany, New York, they manufacture the cheapest and most convenient seed planter that I have ever met with for performing all kinds of seed planting. It can be drawn by a horse, and one man can work it by hand when planting short rows. R. H. Allen & Co., 189 Water street, New York city, make the same style of planters.

At the west, Indian corn planters drawn by one or two horses, are extensively employed for planting the seed of this kind of grain; but at the east and north very few farmers plant their Indian corn with a machine. Numerous hand planters have been manufactured, and distributed by the thousand through the country. But nearly all of them have failed to give satisfaction.

Many eastern farmers steep their seed-corn and tar it just before planting, for the purpose of preventing birds pulling the young plants. Therefore, as it is difficult to plant tarred corn with a machine, corn planters do not meet with that favor with which they are received in the corn-growing States of the west, like Illinois, where more corn is planted by machines than by hand. Furthermore, on numerous farms, the land is too stony, rooty, stumpy, or the surface is so covered with sods that neither a hand corn planter nor one worked by a horse can be made to operate satisfactorily.

DOWLAW'S COTTON PLANTER.

There are several kinds of cotton planters in use in the cotton-growing regions of the southern States; but, like the Indian corn planters of the north and west, the largest proportion of them embraces a lot of worthless machines. The most reliable cotton planter which I have met is manufactured at Hawkersville, about twenty-five miles from Macon, Georgia. • The name of the manufacturer I have not been able to learn. I have not met with a person who has used it who found

any fault with its operation. This cotton planter is constructed somewhat like a small wheelbarrow; the hopper holds about a bushel and a half of seed: with curved bottom of sheet-iron, and made into two parts, capable of being compressed or separated by rods and screws. The wheel has a crank and connecting rod which give a reciprocating motion to about a half a dozen long teeth that pass just through the division of the box. The two sides can be screwed together so as to put half a bushel or less of the seed to the acre; or the orifice can be opened so as to sow three bushels or more if desired. The long teeth pull down the cotton seed as they move to and fro, and secure its dropping regularly.

This planter opens the furrow and sows the seed at the same operation when drawn by one horse or mule. It has also an attachment for distributing guano, bone dust, or other commercial fertilizing matter, which is so arranged that the guano even in windy weather may be dropped so closely to the ground that none of it will be blown away by the wind. This planter may be constructed so as to cover the cotton seed as fast as it distributes it; but by many of the most successful cotton-growers it is not thought the better way to cover the seed with the planter, especially where the land is liable to bake after a heavy rain, so so as to form an impenetrable crust on the surface, which prevents the young cotton plant from coming up.

HISTORY OF MOWERS AND REAPERS.

Most people take for granted that reapers and mowers are of quite modern invention; but such a conclusion is far from being correct. Others have supposed that some American Yankee first conceived the idea of constructing a machine for cutting grain with horses or oxen; but history informs us that reapers were in successful operation before Christopher Columbus discovered the Western Continent; and that the sickle and the scythe, in some of the oriental countries, had been superseded by reapers that were worked by one or two oxen in the early part of the Christian era.

The first account of a machine to reap grain appears to be that given by Pliny the Elder, who was born, it has been supposed, about the year of our Lord 23, more than 1,800 years ago. This historian says: "There are various methods of reaping grain. In the extensive fields of the lowlands of Gaul vans of a large size, with projecting teeth on the forward edge, are driven on two wheels through the standing corn, (oats and barley are called corn,) by an ox yoked in a reverse position, with the machine forward of the ox. In this manner the ears (or what we call heads of barley or panicles of oats) are torn off and fall into the van. In some places the stalks are severed in the middle by sickles, and the ears or heads of grain are stripped off between two hatchels."

Palladius, an eastern ecclesiastical writer, gives the following account of reapers in A. D. 391. He says: "In the Gallic lowlands they employ a more expeditious method of reaping, requiring the assistance of a single ox during the whole of harvest time. A cart is constructed, which moves on two wheels. A low box of boards is constructed on the wheels and the boards in front are lower than the rest. Behind this cart two shafts (or thills) are fastened like the rods of a sedan chair. To these an ox is yoked and harnessed, with his head turned toward the cart; and the ears, or heads, are gathered in the box, the driver regulating the elevation and depression of the teeth with a lever."

The next account of a reaper is given in proposals submitted in Britain in 1785, for constructing a reaper. This machine was propelled forward by a horse or ox, clipping the heads of grain and depositing them in a large box, which was emptied into a storeroom when full. In the details of this machine, a drive-wheel, pulleys, pinions, tooth wheels, and iron combs or teeth are spoken of. In 1799 another reaper is spoken of as being propelled by a horse, hitched behind it, which cut and laid the grain in a swath on one side of the reaper. A boy could manage the machine, and with one horse could cut a swath about two

feet wide, or rather more than could be reaped in the same time by six men with sickles.

In 1806 Mr. Gladstone produced a reaper for cutting grain, delivering the straw into gavels to be bound. Drive-wheels, pulleys, bands, &c., are alluded to in the details of this reaper.

In 1807 Mr. Plunckett constructed a machine in which a horse *drew* the machine instead of *pushing* it forward, according to the usual custom of operating reapers. After this period many inventors entered the field with reapers of an improved construction, and in 1822 Mr. Mann, under the auspices of the Highland Society of Scotland, brought forward a new reaper, which was worked with one horse, and which could reap ten acres in ten hours.

As nearly as I can remember, when I was about six or eight years of age, in 1826 or 1828, Thomas Chadwick, an ingenious mechanic of Genoa, Cayuga county, New York, constructed a rude mower, to be drawn by one horse. This machine consisted of a wheel playing close to the ground horizontally, having numerous scythe-like knives extending out from the periphery, like the spokes of a wheel. A drive-wheel imparted the necessary motion to this wheel armed with numerous scythes.

I never learned what was the cause of its failure, but since becoming a man, although I never saw the machine, I do not want to inquire why a mower constructed on that principle will not operate satisfactorily.

In 1830 a mowing machine was produced, and soon after a combined reaper and mower is spoken of. About that time the celebrated McCormick reaper entered the field, astonishing Americans, as well as the farmers of the Old World. From that time to the present day, reapers and mowers of innumerable forms have come into existence, many of which have ended in total failure, while others have proved a triumphant success.

IMPROVED MOWERS.

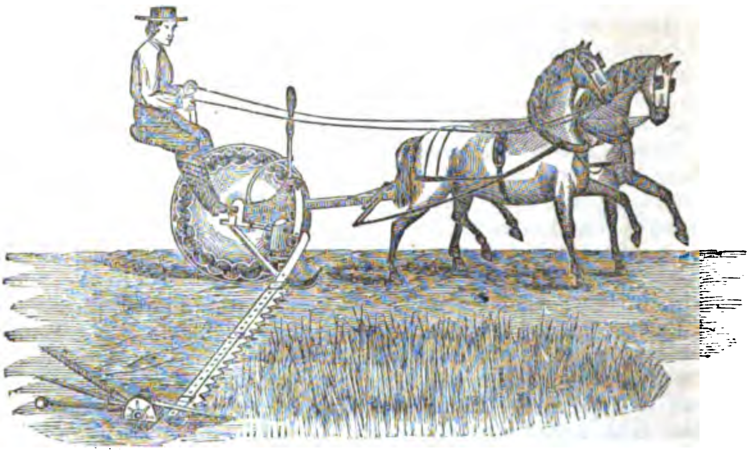
Although most of the mowers that are now manufactured extensively seem to be almost as perfect as machines can be, still there is room for further improvement in many of the working parts of some of the machines; and though there are many excellent implements in the Old World, the United States beats the whole world in the line of mowers, and probably reapers. It has been stated, on reliable authority, that during the year 1866 more than eighty thousand reapers and mowers were manufactured in the United States alone. In 1864, I ascertain that more mowers and reapers were manufactured in the county of Cayuga—and most of them in the city of Auburn—New York, than in any other city or county in the world; and the manufacturers of this kind of farm implements at Auburn continue to turn out a greater number of excellent machines annually, than are made in any other county in America.

Our mowing machines work beautifully. No fault can be found with the mowing. Fortunes have been expended in bringing some of them to their present state of perfection. No talent, nor time, nor experiments, nor money, have been spared in bringing out a most perfect labor-saving implement. Many men have invested all they were worth in stock for making a machine that would beat the world, and met with a grievous failure, simply because they did not understand what was requisite in order to make a perfect machine.

The reader will doubtless inquire, "Which is the best?" No man is able to answer that question satisfactorily. The "Buckeye," manufactured by Adriance & Platt, New York city, as a mower, according to the decisions of committees at trials of mowers, stands without a superior. Next comes the "Clipper," manufactured by R. H. Allen, 189 Water street, New York city. Mowers similar to them are manufactured so extensively over the entire country that it is unnecessary for me to allude to any of them, as our mowers are as perfect as we can desire.

THE NATIONAL REAPER AND MOWER.

As there is such a great variety of reapers and mowers, as well as machines that will only reap, or only mow, and as the largest proportion of them operate quite satisfactorily, I had determined not to give any illustrations of reapers or mowers. But I was so favorably impressed with the simplicity of the improved



National Mower and Reaper, invented by Ridgeway, Fox & Co., 505 West Pratt street, Baltimore, Maryland, that I could not forbear giving an illustration of this machine, rigged for mowing.

This machine is made principally of the very best wrought iron and steel. The main bar is one continuous piece of wrought iron, formed in such a shape as to make a complete frame and cutter-bar. The motion is produced by conical cams in the driving wheel, into which fits a chilled iron conical roller, revolving upon the end of a strong wrought-iron and steel crank, which connects with and gives motion to the knives.

It may be seen by the illustration that there are no gear-wheels nor pinions in this machine. It is a combined machine, and has a self-raker attached, which is said to be strong, simple, and very effective.

As this machine has so few parts, and will reap, mow, and rake off the grain, in a satisfactory manner, and combines all the requisite qualifications of strength, lightness, durability, simplicity of construction, and some other things which constitute a perfect machine, it cannot fail to supplant entirely some other mowers and reapers that will struggle long and desperately for existence.

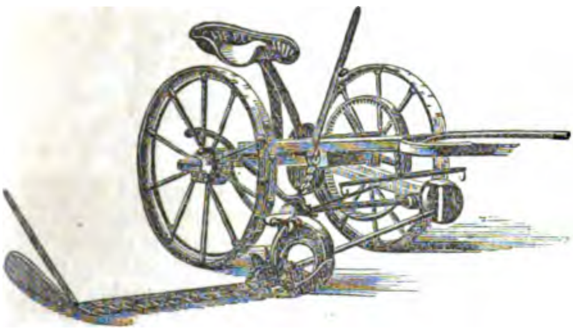
There are thousands of farmers, having but a few acres of land, who are not able to purchase a separate machine to mow and another to reap only a few acres of grain and grass. The machine, therefore, that will adapt itself to the various kinds of work to be done on small farms, is an implement that is, and ever will be, in excellent request all over our country. A machine that a farmer can work alone—that he can mow with, reap with, and that will leave his grain in gavels—is really a labor-saving machine of great value. The implement, therefore, that is the simplest, the cheapest, and at the same time quite as effective as more expensive machines, is the machine for the million.

ONE-HORSE MOWERS.

There are a great many farmers who keep only one horse, and who cut but a small number of acres of grass. If they have a one-horse mower the single

horse can mow all their grass with ease. But if they are required to employ a two-horse mower they cannot always cut their grass at the most suitable period for making the best quality of hay.

To supply the demand for one-horse mowers, R. H. Allen & Co., 189 Water street, New York city, have brought out the one-horse "Pony Clipper," represented by the accompanying illustration. The machine is guided by a pair of thills, hung on a swivel for the purpose of accommodating the horse and the mower when cutting grass on a side hill or along a bank.



I have seen this machine when mowing heavy grass, drawn by one good horse, and it mowed its acre in about seventy minutes, performing its task fully equal to any two-horse mower that is manufactured in the country. The entire machine is made in a neat and workmanlike manner, and of excellent materials; and a strong horse will work such a mower without suffering more fatigue than he would ploughing a stiff sod, when two horses are attached to one plough.

This "Pony Clipper" took the first premium at the great trial of the New York State Agricultural Society, at Auburn, New York, 1866.

A one-horse mower is also manufactured by D. & M. Osborn & Co., Auburn, New York, which has given excellent satisfaction, where a man has only one horse and but a few acres of grass to cut. If a farmer has two horses, or a yoke of oxen, he will always find a two-horse mower more convenient and satisfactory than a one-horse machine, as with a two-horse machine he can drive his haying; but if grass be heavy, and the weather hot, a light horse will make slow progress mowing.

As the Clipper is made chiefly of iron and the proportions well adjusted, and as the design is tasteful, this is a very attractive farm implement.

IMPROVED IMPLEMENTS FOR HANDLING HAY.

There are several kinds of complicated implements for loading hay, after it is cured, but up to the present time of writing there has been nothing brought out and perfected to such a degree that I feel willing to recommend it as worthy of universal adoption, or that will pay farmers for the expense and trouble of making and keeping such machines in working order.

Messrs. Niles & Gillett, Little York, Cortland county, New York, had a hay-loader in operation last season which was supported on two wheels attached to the rear end of the wagon. A kind of sweep-rake gathers the hay into bunches, when a horse fork, let down from a crane, lifts the forkful on to the load. The hay is elevated by winding the rope around a windlass attached to one of the wagon wheels. The pitching must be performed when the wagon is moving; when standing still, the pitchfork cannot be operated. When hay is in cock, or when pitching grain, the fork is thrust into the straw, and the wagon is started, the hay elevated, and the forkful swung around over the load and dropped about the middle of the rigging or load. There is no mistake about the operation of the machine. It will perform all that is claimed for it, so far as raking and pitching are concerned. But whether it will pay on an ordi-

nary farm to make use of such a machine is still a question. The machine has not been tested sufficiently to warrant the indorsement of a labor-saving implement. See remarks under the head of labor-saving machines on another page.

There are two other hay-loading machines which operate differently from the one just described. I regret having lost the names of the inventors. One kind is supported on two wheels, and attached to the rear end of the wagon; the other is secured to the fore end of the wagon. In both machines a system of revolving rake teeth gathers the hay and carries it to the top of a kind of straw carrier, when the rake teeth release their hold, and the bunch of hay carried up by each set of teeth rolls over into the end of the rigging or hay rack. One of these machines was operated by driving lengthwise of a windrow of hay, when the numerous rakes attached to the endless belts carried up a stream of hay so rapidly that the loader could not manage it as fast as brought up.

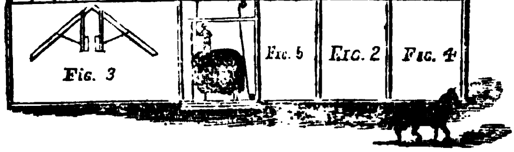
Another kind of loader gathers the hay when it is spread out over the ground, and deposits it in a perpetual stream on the fore end of the wagon.

As all these machines are comparatively new, I have suspended my judgment in regard to their practical value as labor-saving implements. Machines may be practical, fully capable of performing certain operations, yet the character of the work may be such that it will not pay to employ expensive machinery to relieve manual labor. If we had no storms of rain to interfere with making hay, and farmers could always calculate on having their hay in the windrow, or in cock, or spread out, it would be less difficult to employ machinery to place the hay on the wagon.

I do not decry these hay pitchers. If they had been in use sufficiently long to gain the favor of farmers, I would gladly record all that might be said in their favor.

HICKS'S HAY ELEVATOR AND CARRIER.

Almost every farmer knows how laborious and expensive it is to carry hay to the further end of a hay barn, or to the back side of a broad hay-mow. In some instances four or five men are required to pitch the forkfuls from one to another, which is always a very tedious and expensive way to convey hay to a distant part of the mow. The following illustrations will furnish an intelligible idea of the various parts of the elevator and carrier. It was invented by Isaac Hicks, North Hempstead, Long island, New York, and was introduced by John H. Chipman, Utica, New York This elevator and carrier can be readily applied to carrying any other material in a horizontal direction. If a hay barn be two hundred feet long, the hay may enter at one end and be carried in large forkfuls as fast as a horse can walk, to the further bay; or the forkfuls can be dropped at pleasure, wherever the man on the mow choses to have the hay deposited.

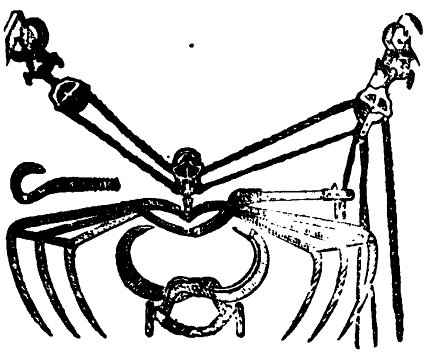


An inclined railway is made from a point over the load to the further side of the mow, consisting of a track made of two by five inch plank fastened to the rafters a few inches below the ridge of the barn by one and a half inch square

strips and twelve-penny nails. Upon this track runs a car, and a rope passes through it and through a catch-pulley attached to a horse hay fork, then back to the car; the other end passes back to the end of the barn, and returns through pulley wheels to the barn floor, to which end a horse is attached. A cross section of the railway is shown at Fig. 3. Pieces are spiked to the rafters, to the lower ends of which the planks are secured. Braces are nailed to the rafters and to the hangers to keep the track from spreading.

By a peculiar arrangement of the car, it is held in position on the track over the load until a forkful of hay is elevated to it, when it is liberated from its position and the fork made fast to the car in one operation; then it moves on the track very easily to any desired point. The operator, by pulling a cord, trips the fork, and the horse turns around and walks or trots back to the place of starting. The car is pulled back to its position by the trip cord, when the fork descends for another load. The fork comes back so easily and quickly that the horse can be kept in motion continually, elevating from 300 to 400 pounds of hay and carrying it forty to fifty feet, in a horizontal direction, and returning for another load in less than a minute.

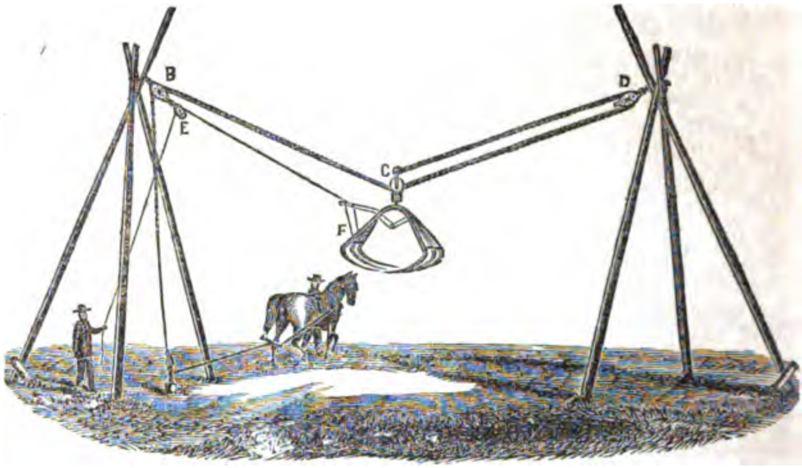
Almost everything is performed automatically where a fork is used with this elevator and carrier, which may be employed in unloading coal, when it is desirable to carry it fifty or a hundred feet in a horizontal direction. By having two movable pulleys attached to the coal tub, one horse can elevate 800 pounds of coal quarter as fast as he walks; and as soon as the tub reaches the car it is made fast to it and moves off horizontally as fast as the horse walks. The operator on the boat, by a trip-cord, upsets the tub anywhere, and pulls the car and tub back. The driver having unhooked the rope from the whiffletree as soon as the cord falls, drives back to the snatch-block and hooks on his rope again; the tub descends at the will of the operator, and is unhooked and a loaded tub hooked on. The car for coal should be made larger and stronger than the one for hay.



The illustration, figure 1, herewith given, represents the manner of securing the fork and pulleys to the rafters by means of two grapples, one of which is shown at figure 3, which is capable of receiving a large rafter. Figure 2 is a representation of a screw-hook, which may be screwed into a beam or post wherever it is desirable to secure a fixed pulley. Such a hook is screwed into the sill of the barn, and a pulley is attached to it; and the slack rope to which the horse is hitched is worked in this pulley.

The accompanying illustration represents the manner of arranging "gin poles" for the purpose of pitching hay on a high and long stack. Let us suppose, for example, that a stack is to be thirty feet long; then set up the gin poles at least forty-four feet apart, in order to allow a load of hay to pass between the end of the stack and the poles at A. The rope passes from the horse under the pulley at A, over a pulley at B, under a pulley at C, around one at D, when the end is secured at C. The operator draws the fork to him at A, and thrusts it into the hay. The horse is then started, when the forkful rises towards E, until it is sufficiently elevated to move off over the stack. The person on the stack thrusts his fork into the forkful, and pushes it either to the right or left, giving a signal, at the same instant, to the man on the load to jerk the cord and drop the hay, wherever the stacker desires to have it deposited. This saves a vast amount of laborious pitching. Besides this, a stacker can construct a stack that will settle more

uniformly when hay is pitched by a fork arranged in this manner than when laborers are required to do it by hand.



This illustration shows how three poles may be secured at the upper ends by clevises. The poles for such purposes should be long and light. The upper ends need not be more than three inches in diameter. The upper ends of the poles are kept from being drawn over towards each other by lashing the lower end of one pole to a strong stake in the ground.

It affords me pleasure to speak of the eminent efficiency of this apparatus, as I have used the different parts with my own hands, and know them to be great labor-saving machines.

Another self-sustaining horse fork may be used with this apparatus instead of Raymond's grappling elevator. This fork took the second premium in class 1st at the great trial of horse forks held at Rye, Westchester county, New York, March 4th and 5th, 1867.

WALKER'S HARPOON FORK.

Fig. 1.

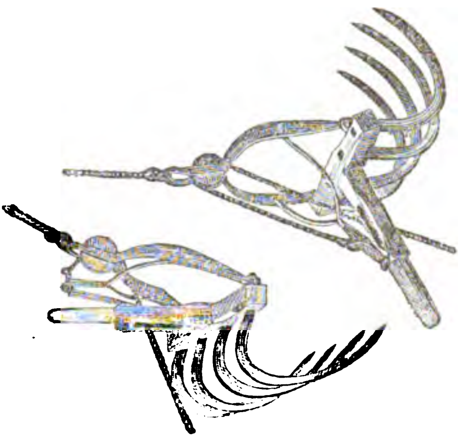
Fig. 2.

The illustration herewith given represents a harpoon fork that has been in extensive use sufficiently long to test its merits. Large numbers of them have been manufactured by Wheeler, Melick & Co., Albany, New York.

The manufacturers say of this style of fork that it stands unrivalled among the various kinds of horse forks. Having been put in use the past season by nearly 15,000 practical farmers, who speak of it in the highest terms of praise, it is unnecessary for us to speak of its merits.

This harpoon fork is made of iron and steel, weighing only a few pounds. After it is thrust into the hay, the part forming the point is turned up at a right angle so as to hold the hay or straw.

PALMER'S HORSE FORK.

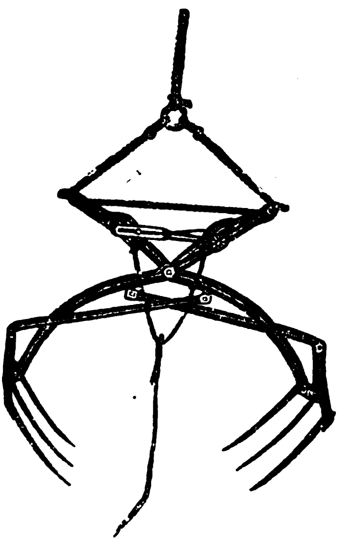


The illustration herewith given represents an independent fork, with sickle tines, which is considered one of the best horse forks ever invented. Some farmers will have no other style of fork, feeling assured that this has no equal. It is light, strong, and easily handled by a small boy or feeble man, and can be used where hay can be pitched with any other horse fork. Rev. Nelson Palmer, Hudson, New York, is the inventor, and I think Wheeler, Melick & Co., Albany, New York, manufacture it. It is also manufactured by parties in Chicago, Illinois.

This Palmer fork, at the great trial of forks under the auspices of the American Institute, March 4 and 5, at Rye, Westchester county, New York, received the first prize, as being the best fork in the country for all kinds of work. The committee thought that this fork would pitch hay and other material equal to any other fork, and would excel all others when pitching coarse manure.

BUCKMAN'S GRAPPLING FORK.

It will be observed by the illustration, representing Buckman's horse fork, that this fork is more complicated than any others that I have noticed.



The tines are made of steel, and the heads of the forks, arms, and levers are all of iron. After the forks have been thrust into the hay, nearly in a perpendicular direction, as the upper ends of the levers are drawn together, the forks approach each other, and the lower ends of the tines are lifted so as to stand nearly in a horizontal position.

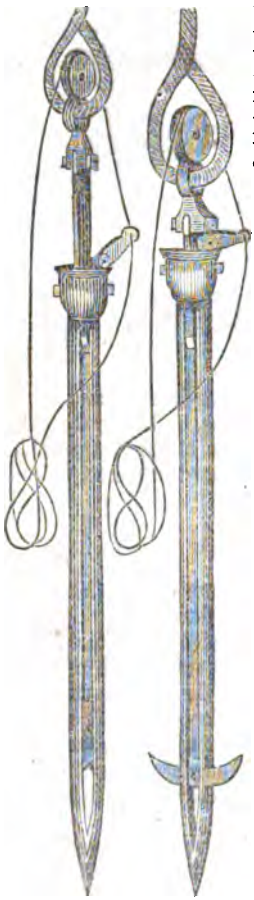
The inventors claim that by this arrangement of the different parts of the fork, an advantage is gained over the other forks for pitching fine hay, short, loose grain, fine straw, and any other material that will not hang together like flax straw.

By simply changing the fork head for a grapple head, which is furnished with each at a trifling additional cost, it may be used for raising baled cotton, tobacco, hops, barrels, boxes, and all other heavy baled or boxed articles. It is capable of raising 600 pounds with ease and safety, and it will grapple and hold any article not exceeding 3 feet in width. A large number of farmers have pronounced this fork the best in use for all kinds of work.

IMPROVED HARPOON FORK.

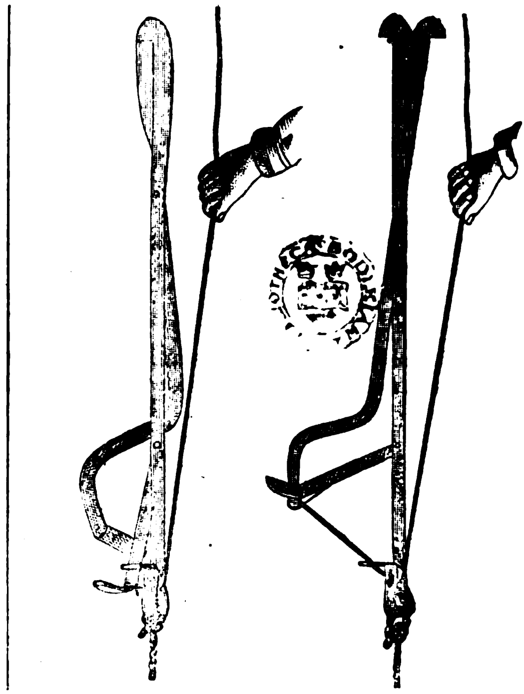
The accompanying illustration represents still another style of harpoon forks,

having two barbs. These forks are made of steel, are light and strong, and will operate with satisfactory efficiency. The figure at the left hand represents the fork as it appears when thrust into the hay.



The illustration on the right hand shows the fork with the barbs spread, as they are arranged after the fork is thrust into the hay. This kind of fork is manufactured by H. D. Rogers, Pittsburg, Pennsylvania, and by W. H. Field, Portchester, Westchester county, New York. I have handled this fork, and it pitched unusually large forkfuls at the trial of forks to which I have alluded in other parts of this chapter.

COMBINED FORK AND KNIFE.



The horse fork and knife herewith represented was invented by Kniffen & Harrington, Worcester, Massachusetts. Persons who have used this style of fork for pitching hay, and the knife for cutting down hay mow or stack, speak of it in high terms. The manufacturers affirm that it is the most useful implement for cutting down and pitching hay that was ever invented, as the knife is more efficient than any hay knife ever before constructed. The directions for using it are as follows: Put the fork into the hay when shut, then open it, when it is ready for working. A small rope passes over the pulley in the main fork stem, and fastens to the short handle, which, when drawn by the operator, drops the hay. When cutting hay on mow or stack open the fork and press it into the hay the depth you wish to cut, then shut and draw it out; repeat this, being careful to enter the knife so as to cut all the hay. Full six inches may be cut each time the knife can be put in. Care should be taken to keep the knife sharp when using. When sharpening the knife grind only on the one side of each blade, or the same as when sharpening a pair of shears. To load a

wagon from a mow, cut down about two feet deep, six feet long, and of convenient width, insert the fork shut into the centre of the block, then open it and drive ahead.

A combined hay fork and knife similar to this is made by S. E. & B. Sprout, Muncy, Lycoming county, Pennsylvania, which drew the second prize at the trial of forks at Rye, Westchester county, New York, March 4 and 5, 1867, under the auspices of the American Institute. This fork, at the trial of implements held under the auspices of the New York State Agricultural Society, July 10, 1866, pitched off 1,810 pounds of hay over the large beam at five forkfuls, in two minutes and forty-five seconds. When pitching under the beam, the same fork removed 2,000 pounds of hay in one minute and forty-one seconds. The hay hangs to the shoulders or hooks in the sides of the blades.

WHICH IS THE BEST FORK.

Every farmer will, doubtless, inquire which is the best fork. The answer can be given in a few words, namely, the one that will pitch all kinds of hay, straw, or loose grain. A farmer does not wish to incur the expense of two horse forks. This is not necessary when there are forks that will pitch any material in the most satisfactory manner. A fork of almost any style will pitch long hay or loose flax that will hang together like curled hair. Every practical farmer will readily appreciate and understand the requirements of a horse fork when I allude to material to be pitched.

We sometimes have short oats—so short that the straw is not long enough to make bands for binding the bundle. Barley straw is frequently so short and slippery that one almost wants a huge scoop shovel for handling it. Besides these, some farmers have rowen to pitch, which is almost as short as chaff. The straw of red clover seed and of white clover seed is sometimes so short that it is exceedingly difficult to pitch. Many farmers use a grappling fork for loading long manure on a wagon; and in some instances they save a vast deal of hard labor by making a horse or two horses perform this laborious task.

Here, then, we have the facts for enabling us to decide, without a trial, which is the best fork. A harpoon fork can hold only a small bunch of short, slippery barley straw, a small bunch of oats, or a small forkful of short clover straw; and a man can pitch manure faster by hand than he can with a horse and a harpoon fork. But a grappling fork will hold a large bunch of any fine hay, short and slippery barley, short oats or long coarse hay, and although a grappling fork cannot be employed satisfactorily in pitching all kinds of manure, still if manure of any kind can be pitched at all with a horse fork, the grappling fork will give the best satisfaction. For some kinds of work, the harpoon fork may be preferable.

These suggestions might be greatly prolonged; but I trust I have recorded a sufficient number of hints to enable most farmers to choose a fork that will always operate satisfactorily.

THRESHING MACHINE.

Our threshing machines are as perfect as they can be made. It is truly surprising to witness their eminent efficiency for threshing any kind of grain. We have one-horse, two-horse, three-horse, and ten-horse powers. The first one that demands our notice is a two-horse railway power with a separator and cleaner, which is manufactured by R. & M. Harder, Cobleskill, Schoharie county, New York.

These machines have gained a wonderful popularity; and they are becoming more and more popular all over the country. This kind of powers and threshers is gaining favor at the west very rapidly, and I am inclined to think that the

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day is coming when the railway horse-powers will entirely supplant the sweep powers. The first question that is almost always asked is: wherein does Harper's power differ from Wheeler & Melick's? They are substantially the same. The platform wheels of Harder's power are larger in diameter than those on other machines. It is therefore contended that a horse of a given weight will be able to exert more effective force with wheels of that size than if smaller ones were substituted. Other manufacturers dispute this point.

The thresher is an over-shot machine; and the entire machine is the very paragon of perfection. With two horses such a machine will thresh from 300 to 500 bushels of oats per day of ten hours, and half that quantity of good wheat, and deliver it clean and ready for market.

When ordered each thresher is built with a dust flue, for the purpose of protecting the man who feeds the machine from the suffocating dust which is often so injurious to any person who has sensitive lungs. This dust flue is simply an open passage or flue outside of the concave over the cylinder. The dust enters the flue in front of the machine and is carried out over the cylinder with the straw. This is said to be a complete preventive of the dust flying in the feeder's face.

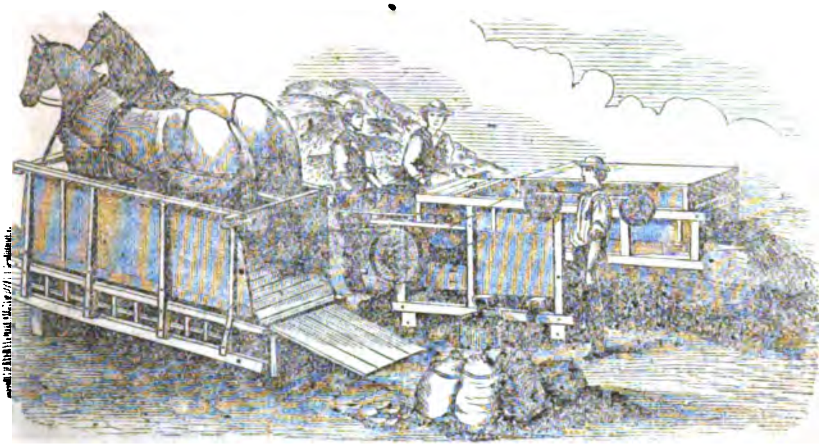
WHEELER'S RAILWAY POWERS AND THRESHER.

Messrs. Wheeler, Melick & Co., Albany, New York, manufacture railway horse-powers for one horse, for two horses, and those sufficiently wide to admit of three horses abreast.

I cannot recommend this machine too highly. When I was on the farm I purchased a one-horse power. It pleased us well, but I soon procured a two-horse power, which gave excellent satisfaction. I used that power for almost every purpose. I threshed all my grain with it; threshed and hulled my clover-seed; chaffed all my fodder; sawed the firewood with a circular saw; worked the drag saw; ripped out laths and all kinds of lumber when building my house; shelled Indian corn; turned the grindstone, and drove my turning-lathe.

The three-horse power differs from the two-horse power only in having a middle support, which is constructed by placing iron rollers under the centre of lags, which carries two-thirds of the weight of the horses, rendering it even more durable than the two-horse power. It is also well adapted for two horses, and is easily transported, its weight being but about 250 pounds more than the ordinary two-horse power, and can be mounted on common wheels and axles, by means of frame and windlass, by which one man can load and unload in a short time.

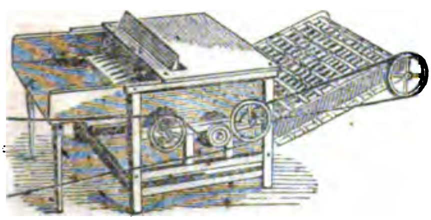
The three-horse powers are employed quite extensively for the threshing of grain and sawing firewood. With three good horses, a set of hands can saw as much firewood as can be sawed by a ten-horse sweep power with the same saw.



The erroneous idea that such powers are "horse killers," does not meet with much favor among intelligent farmers. I used a span of horses on one of Wheeler's machines for more than ten years, and I know it never injured them any more than to travel on the ground. I have seen it stated in print that the use of such powers is as cruel as slavery. I am certain that the men who make such assertions are not the proper persons to give an opinion on such a subject, as I think they have never used such horse-powers for any considerable length of time.

PALMER'S CLIMAX THRESHER.

One of the most ingenious and useful threshing machines in the country is represented by the accompanying illustration of "Palmer's Climax Thresher,"



which has been sufficiently tested to satisfy every one who knows what is required in a good thresher, that it is a machine of superior excellence. I have not only seen this machine in operation, but I have fed it with my own hands; and I know it to be all that can be desired in a machine that is designed for preserving the straw straight and unbroken. In those parts of the country where rye is grown more than any other grain such a machine is eminently desirable, as it will deliver the long straw in straight gavels more evenly than it was before the grain was threshed out.

The machine consists of two drum cylinders about five and a half feet long and fourteen inches in diameter, made to revolve towards each other. The cylinder that threshes the grain is corrugated on the surface, and revolves close to a corrugated concave, which can be screwed up so closely to the cylinder that it is impossible for a head of any kind of cereal grain to pass through without being threshed. The other cylinder is furnished with spikes which carry the straw down between the cylinders, dropping a small quantity at once, right at the entrance between the corrugated cylinder and the concave.

The unthreshed grain is fed sideways into the machine instead of lengthways.

If some of the straws enter in a diagonal direction, they will be brought out straight. The straw is carried by the carrier beyond the rear end, where it is deposited in gavels of any desired size. When the machine is in operation, two active laborers will bind the straw as fast as the machine threshes it.

Straw threshed with such a machine is much more valuable in market than if it had been threshed with a machine that breaks it into short pieces; and more than this, the bundles can be stored in a smaller space, and it is more convenient for being fed into a straw cutter after being threshed.

This machine will thresh all kinds of cereal grain as fast as spiked machines; and when the straw is long and heavy, I think it will thresh faster, with the same power, than the other threshers which shell out the grain by means of spikes.

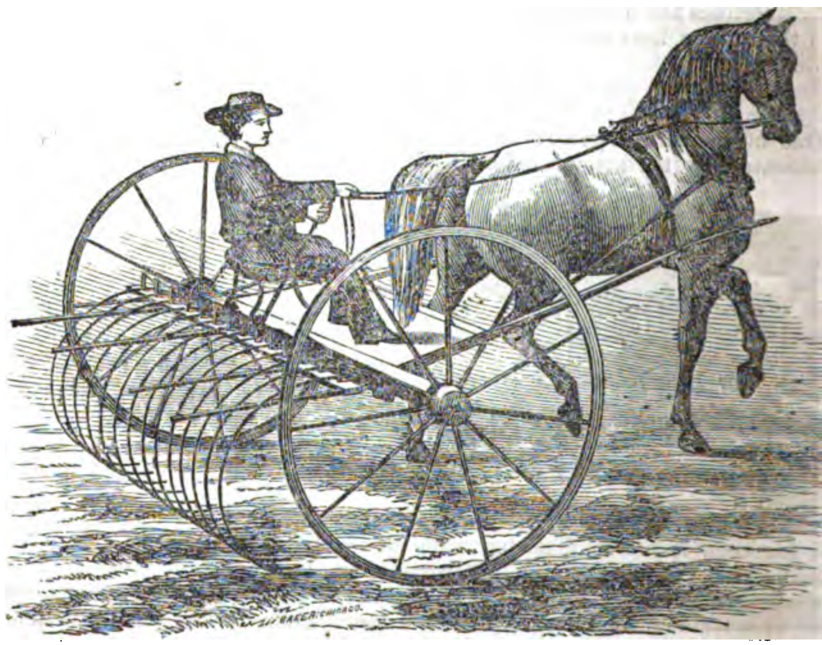
Two horses will drive such a machine, when attached to a railway power, and do a fair business, but a three-horse railway power will give the cylinders a furious velocity; and an active man will be obliged to work lively in order to feed the machine to the capacity of the thresher.

The reason why such a machine will thresh long heavy straw more rapidly than a spiked thresher, is, that a large proportion of the effective force of the team is absorbed in breaking the straw to pieces by means of the spikes, while the corrugated cylinder works the long straw through the machine with the expenditure of little power.

With spiked machines, more of the effective force of a team is absorbed in breaking the straw to pieces than is required to thresh out the grain.

IMPROVED HORSE RAKES.

The improvements in horse rakes are as various as the machines are numerous. It seems as if inventors had exerted themselves to the utmost to devolop some-



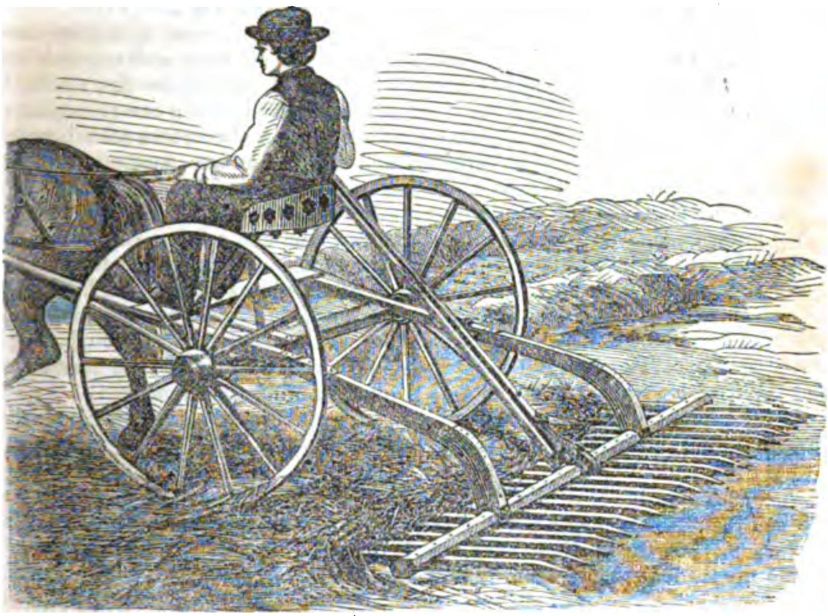
thing new in the shape of a horse rake. There may be a better kind than the one here represented; yet whoever gets one of this style of steel-toothed rakes, may feel assured that he has a good implement. This rake was invented and

manufactured by Messrs. Sprout, at Muncy, Lycoming connty, Pennsylvania, and has taken several premiums at State agricultural fairs a the best rake.

A spring toothed rake of superior excellence is now manufactured by Dodge & Co., Auburn, Cayuga county, New York.

TRACY'S REVOLVING RAKE.

The best rake, according to my idea of horse rakes, for all kinds of work, is the common wooden-toothed revolving rake, attached to a sulkey, on which the operator rides, as represented by the accompanying illustration, holding the rake



with one hand, by means of a lever and spring latch, both of which the driver manages easily with one hand. This improvement was brought out by H. N. Tracy, Essex Junction, Vermont. I think this style of rake possesses advantages over the steel-toothed rakes which render it pre-eminently superior to any other rake now in use. I will allude to the points of superiority. It will rake wheat or barley stubble cleaner than the steel-toothed rakes, and will not tear up the young and tender grass, nor collect so much grit and dirt among the straw and hay as a steel-toothed rake. With this kind of wooden-toothed revolving rake peas can be raked, before the vines are mowed, into close winrows; and red clover seed can be raked cleaner, when the straw is very short, than can be gathered with any other rake, as the wooden-toothed revolving rake gathers and holds heads of clover and short hay more advantageously than most others.

CLOVER THRESHERS AND HULLERS.

Only about thirty years ago clover seed was removed from the chaff by the slow and laborious operation of pounding it out with the flail. A faithful and strong laborer who could ply the flail from morning till night was thought to perform a fair day's work if he hulled one peck, or fifteen pounds, of clean clover seed, during that period of time. In some instances farmers would tread the seed out with horses and colts. The heads were separated first from the straw, then

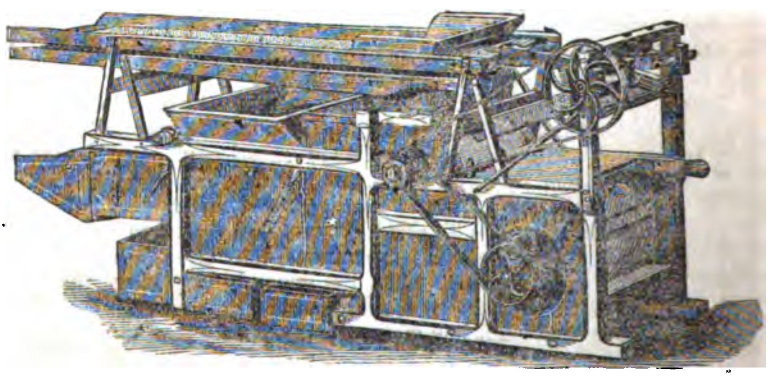
all the horses and colts that could be collected on the farm were put on the barn floor and kept moving round and round, day after day, on the chaff. It was a long and tedious job to hull clover seed. The feet of the animals, by constant attrition, wore the chaff through to the seed, and most of it would separate readily from the chaff when it was passed through a fanning mill. After the job was pronounced finished, there still remained one-fourth or more of the seed in the chaff, which was sowed chaff and all. Cleaning clover seed was an exceedingly dirty and unhealthy job, on account of the offensive dust which always arises when the seed is being hulled.

The first step towards cleaning seed by machinery was accomplished by one of the most rudely constructed machines. It consisted of an upright wooden shaft, about one foot in diameter at the lower end, and larger at a distance of four feet from the floor. A portion of it was turned off true, and covered with pieces of tin been punched full of holes. The rough side of the tin, similar to a grater, was on the outside of the shaft cylinder, which made one revolution to one circuit of the horse. This grater-shaft worked in the centre of a concave, extending entirely around the cylinder, and the inside was covered with perforated tin, which presented a rough surface. The chaff was forced in at the top, and came out slowly at the narrow opening between the cylinder and the concave at the lower end. With such a rude machine a man and a horse could hull one bushel of clean seed in a day. This was the commencement of hulling clover seed by machinery. After this a cylinder, revolving horizontally, and having the periphery covered with band iron, with the surface of the iron prepared like a rasp, was brought into use. The concave was also covered with iron, having a rasped surface. The concave of such machines can be adjusted by a screw, so that the chaff is stripped from the seed without injuring the kernels.

At the present day hulling clover seed can be performed so expeditiously that farmers do not dread to raise it as they once did.

WESTINGHOUSE'S IMPROVED CLOVER HULLER.

The illustration herewith given represents a clover huller made by G. Westinghouse, Schenectady, New York. It is difficult to pen a description that will enable the reader to understand it perfectly.



This huller is designed to be used for simply hulling the seed after the heads have been threshed off the straw. It performs the work with great rapidity and neatness. The chaff, when it leaves the huller, contains no seed that is of any value.

The combined huller consists of a thresher, huller, and cleaner, which are all in one frame, and the whole entirely covered and arranged for use on a wagon. A pulley on the hulling cylinder receives the belt from the power, and belts from

this cylinder connect with the other machinery, so that the entire operation of threshing, hulling and cleaning is done at one time. The manufacturers say:

"We have experimented extensively with different plans of making the hulling cylinder and concave, and have found that for durability and efficiency there is nothing superior to a closely spiked cylinder, with spikes case hardened, and an iron concave, and have therefore adopted this plan in our machines. Particular attention has also been given to the cleaning part of our machines. The sieves are long and wide, and so arranged that little, if any, seed will be carried over them. The shoe that holds the sieves receives a back and forward motion directly from the fan shaft, requiring but little power to operate it, cleans the seed, and delivers it at the side. The bolt attached to the huller and cleaner removes the straw left in the clover by the thresher, and feeds the cylinder evenly. It is considered indispensable by all who have used machines with it. An elevator is attached to the combined thresher, huller, and cleaner, for returning clover to the hulling cylinder which has not been perfectly hulled the first time through. We make two sizes of these machines—No. 1, thirty-six-inch cylinder, and No. 2, twenty-seven-inch cylinder. The combined threshers, hullers, and cleaners require from six to ten horse-powers, and the hullers and cleaners two and three horse endless-chain powers, or four to six horse lever powers. Their capacity depends very much upon the quality and condition of the clover, varying with the large machines (No. 1) from ten to forty bushels, and with small ones (No. 2) from five to twenty-five bushels per day.

"Clover is perhaps the most variable of any grain as regards yield and condition in which it is necessary to prepare it for market. Many times it is wet, so that it is almost impossible to rub the seed from the heads; and again, the yield is so light that an immense bulk of chaff has to be put through a machine to obtain a little seed. This variableness makes it impossible to have a machine work equally well at all times in it, and we do not claim that the machines we make will do so."

Similar clover hullers are manufactured at Chicago and other western cities. Good farmers feel that it is so much better to have their clover seed clean when they are sowing it than to scatter it in the chaff, that a clover huller is a machine of great value. In many localities, where large crops of clover seed are grown, the large combined ten-horse machines thresh and hull the seed at one operation. The tailings are returned to the huller until all the seed is hulled, and the light chaff is carried beyond the tailboard.

CHAFFING FODDER AND FODDER CUTTERS.

The improvements made in machines within a few years past for chaffing coarse fodder are numerous, but only a few of them are really worthy of notice here. A large number of devices have been patented for chaffing coarse fodder, but the number of cutters that are likely to come into general use or to give satisfaction is exceedingly small. Many good machines I shall not notice, because they are too complicated for common farmers and their laborers, who possess only ordinary ability to keep machinery in running order, and to operate such implements with skill and efficiency.

Some inventors and manufacturers have erred seriously in constructing fodder cutters by not understanding exactly what is required of a machine for chaffing stalks, straw, and hay. In some instances manufacturers have contended that a fodder cutter possessed merit just in proportion to its ability to cut or reduce fodder to a finely comminuted condition. But men who have a correct understanding of the management of domestic animals and of preparing their food, know that the fodder cutter that cuts hay or straw finest or shortest is by no means the most effective cutter.

In chaffing coarse fodder it is not necessary to cut the stalks as fine as has

been sometimes recommended in some of our agricultural journals, because experience proves that fodder digests much better after being macerated by the teeth of animals than when it is reduced so fine by a straw cutter that the stock swallow it without first crushing it between their teeth.

When corn-stalks are chaffed two inches in length a cow can masticate them with little difficulty, and there is no danger that the flinty portions will injure the animal; but when cut into very short pieces much more labor is required to do the chaffing, and the liability to injure the mouth by chewing the hard, flinty pieces of stalks is greatly increased. Short pieces of hard corn-stalks that have been cut off square by a straw cutter often wound the gums of an animal so severely that they will endure severe hunger before they will eat fodder prepared in that manner.

The stalks of Indian corn or sorghum should never be cut less than two inches long. When the pieces are longer than the diameter of the stalk they will always rest on their sides between the teeth of the animal. On the contrary, when the pieces are cut shorter than the diameter of the stalks, the *ends* are presented to the teeth, and the flinty scale will enter the gums almost as readily as a scale of iron or glass.

There is really no advantage in chaffing prime hay for animals that chew the cud, while there is profit in cutting it one inch long for those animals that do not chew the cud, such as horses and mules. The advantage arising from chaffing prime hay for horse-feed consists in this, that the nourishment is rendered more available by being partially prepared for the stomach by some more effective mechanical means than the teeth. Horses and mules masticate their food before it is received into the stomach more than neat cattle or sheep do. Therefore there is greater need of coarse fodder being chopped for horses. Neat cattle and sheep chew their fodder but little until after it has lain in the first stomach until the hard particles have become quite soft.

Some manufacturers of straw cutters, in their enthusiasm over the merits of a new machine for cutting corn-stalks, straw, and hay, have even gone so far as to assert that it increases the value of coarse fodder sometimes one-half to run it through a straw cutter. This cannot be. If there is but little nourishment in hay, straw, or stalks of Indian corn, the simple process of chaffing the fodder by passing it through a cutter will not add to or take away from its nutritive value. If hay be poor and weather-beaten, no straw cutter will restore even a small part of the lost valuable portions that would have afforded nourishment to domestic animals. The principal advantage in chaffing coarse fodder consists in rendering the nourishment in the fodder more available than it would be were the coarse stalks not reduced fine by some mechanical means besides the teeth of the animals.

The machine therefore that will reduce the largest quantity of coarse fodder to chaff of the most approved condition, as to length of pieces of straw and stalks, with the expenditure of the smallest amount of force of teams or workmen, is the best machine for general use.

A large number of fodder cutters have been made with a knife having a reciprocating motion, up and down, most of which have failed to perform as satisfactorily as those cutters that operate with revolving knives. The grand difficulty with straw cutters the knives of which operate with a reciprocating motion, is, the knife prevents the advance of the material to be chaffed. The knife must rise to the upper side of the fodder in the feed box, before the feed rollers can force it forward. For this reason the straw or stalks to be cut do not have sufficient time to be forced forward as far as it is desirable to cut, at each stroke of the knife. Such machines will cut fodder very fine, but they operate amazingly slow. When driven with unusual rapidity some of them will not cut so fast as when the wheel is made to revolve at a slower velocity.

The philosophical reason for this is, the feed rollers do not move the fodder forward with a gradual motion, but they operate by quick jerks, which is not the

movement required for feeding rollers of a straw cutter. The rollers should move the straw forward with a steady and uniform motion.

Fodder cutters have been constructed with a knife playing up and down with a drawing stroke, across the end of the feed box. But the same difficulty was met with in machines of this kind, as, when the knife played up and down without any drawing stroke, the material to be cut could not be fed through as fast as it is desirable to cut it.

Another style of fodder cutter was operated by a knife attached to two balance wheels. The rims of the two wheels were about one foot apart, and both revolved in the same direction. The knife was secured to the wheels by wrist pins, similar to the connecting pitman that extends from one driving wheel of a locomotive to the other. The knife had a very drawing stroke across the end of a feed box. Little power was required to cut off a large box full of fodder. But the difficulty in the way of its success was, the knife prevented the fodder from being fed through as fast as it is desirable to cut it. This style of cutters is one of the most effective of all those that operate with a reciprocating motion, but mechanics and farmers have learned that in order to chaff fodder rapidly, they must have fodder cutters that operate with a rotary instead of a reciprocating motion.

REVOLVING FODDER CUTTERS.

The knives of a fodder cutter, in order to operate with great rapidity, must revolve. The knife or knives may be secured to the side or face of a wheel, or they may be attached to the periphery of a wheel or to cylinder heads. In either case, cutters are now made to operate with astonishing rapidity. In some instances circular knives have been attached to the side of a balance wheel; and machines are manufactured with straight knives, both of which shave off the fodder as it is forced out the end of a feeding box.

The circular knives gave more of a drawing cut, thus absorbing less of the effective force required to drive the machine than the straight knives. But as circular knives are much more expensive and require more skill to put the cutting edge in order, cutters with straight knives cost less and take the preference.

INDIAN CORN HARVESTERS.

In the western States there have been put in operation several horse "corn cutters," for cutting up the stalks of Indian corn, whether they are standing in hills or in drills; but up to the present writing such farm implements have not come into general use. Although it is claimed that such machines will perform their tasks in a most perfect manner, yet they must be considered as only experimental machines, requiring more or less remodelling and improving. In some instances only one experimental machine has been made, and the inventor is hoping that wealthy manufacturers will purchase territory, or pay a generous royalty for the privilege of manufacturing such corn cutters. A brief description of one of these implements may be given as follows: The frame is supported on two driving wheels which are placed sufficiently far apart for the machine to cut two rows. The machine is drawn by a single horse, and the driver rides on the machine. If the stalks stand erect tolerably well, they will be laid in gavels of convenient size for one man to handle with ease. If the stalks be heavy, and many of them laid badly, it is difficult to perform the work in a satisfactory manner.

I thought best not to give illustrations of any of these corn cutters in this chapter, as they have not been brought to that degree of perfection which is desirable for such farm implements.

CORN-HUSKING MACHINERY.

During the past year a machine has been introduced which is destined to

change the almost endless task of corn-husking into a rapid and attractive mechanical process. Such an implement has long been needed, and its introduction will afford a means of saving for the market hundreds of bushels of corn now wasted. Our enormous corn crop, amounting to nearly a thousand million bushels annually, is chiefly raised by the use of machinery. Manual labor only to a small extent is used in producing the crop up to the harvest time. Then commences the hand work. With large crops and costly labor, the corn-growers find t impossible to place the cereal in market at the most auspicious moment; much of the crop is, therefore, fed to stock without husking, and immense quantities are wasted. The husks, too, are mostly lost, because, to preserve them, every husk must be grasped by the human hand. Yet the husk crop is one of the most valuable which we produce. It would amount, if saved, according to the estimate of some persons, to not less than 8,000,000 tons annually; and would bring, at $15 per ton, $120,000,000. In Austria the husks make paper superior to that made from linen rags. The largest paper-mills in the world—those near Vienna—employ nothing but husks, brought from Hungary, and costing $40 per ton, about the price of white rags in the Austrian market. From the long fibre of the husk excellent cloth is made; from the short fibre paper of superior quality is produced, while the gluten of the husk makes excellent bread. These valuable articles are obtained to the extent of sixty per cent. of the entire weight of the husks employed. The machinery to which we allude affords a ready means of preserving these valuable substances. It receives the stalks as cut from the field, picks off the corn, cuts or bruises the stalks, and removes from the ears every vestige of husk and silk. The cleanly husked corn is deposited in one receptacle, the stalks in another, while a third receives the bright husks. The corn is thus made ready for the shelter, the husks for the baling press, preparatory to being sent to the paper-mills, while the stalks are improved for fodder. The work is done rapidly, a machine driven by one horse being capable of husking thirty bushels per hour. One man can turn the crank and feed the machine, and husk out about fifteen bushels an hour. The machine, as now constructed, weighs about 200 pounds, and costs $75. It is manufactured by Messrs. Frank Fuller & Co., 57 Broadway, New York city, and will be largely introduced the present year.

The husker, at first sight, resembles a fodder cutter. At one end of the frame which supports the machinery there are two rollers which revolve towards each other. The top roller is plain, made of hard wood, and some four or five inches in diameter. The lower roller is studded with stiff knives set securely into the surface, so that if the two rollers are screwed closely together they will cut the stalks into pieces about one and a half inches long. The stalks are fed between these rollers, but-ends first. When the but-ends of the ears arrive at the rollers, as they cannot pass through, the knives cut or pinch off the stem, when most of the husks pass through with the stalks, and the ear drops down on two small rollers, about two inches in diameter, which are set at an inclination endways, so that the ears, in slipping along in the depression made by the two rollers, have all the husks and silk stripped off them by the two rollers beneath the ear of grain. A small shaft, with small sharp spikes in it, causes the ears to revolve as they slide along, so that every side of the ear is presented to the rollers, when in motion, which seize every husk and all the silk, and strip them off as neatly as can be done by hand and with great rapidity. One horse will drive the machine to husk as fast as one man can place the stalks on the feeding box.

A point of transcendent excellence of this husker is, it will strip the husks from large ears and small ones with equal facility and neatness, without any alteration of the machinery.

Still another thing which farmers will find to be of eminent advantage by husking their corn with these machines is this: When the ears are husked by

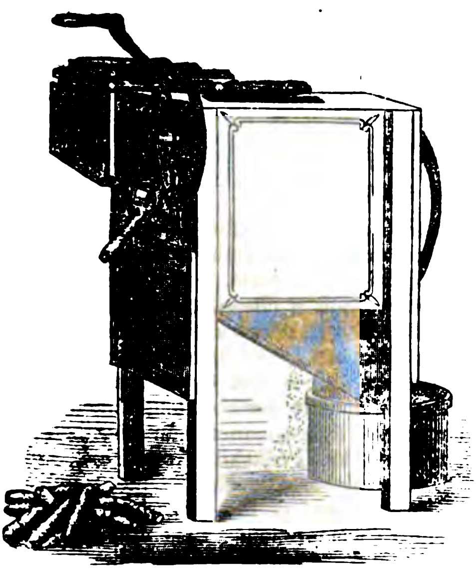
hand the stalks are always a long time in curing, as the pith is full of sap. But when the stalks have been run through the husking machine, the large ones are crushed so that the moisture will escape in a few days, and in less time than would be required to dry out and cure large whole stocks. The man, therefore, who husks corn with such a husker, will be able to dry and cure his crop of corn-stalks in a few days, and thus save a vast amount of excellent fodder which must be lost in curing if the large stalks are not crushed so as to allow the moisture to escape readily. It is the large amount of sap in the big joints and pith of the corn-stalks that causes the stalks to heat and mould after they have been secured in a stack or mow.

Another husker, which operates on the same principle, has two broad, endless aprons of India-rubber revolving together, and the husks and silk are drawn down between the belts or aprons exactly as they are taken off by the rollers in the machine previously described.

These machines are of recent invention, and they have not, as yet, come into general use, but I have been familiar with the husking of the experimental machines for several months past, and am satisfied that this husker is destined to work out a complete revolution in husking Indian corn. The mechanism of this machine will, doubtless, be greatly improved in a few more months. The principle on which it operates is the correct one, and it far transcends everything before invented for husking Indian corn.

THE BRINKERHOFF HAND CORN SHELLER, SEPARATOR, AND CLEANER.

Every farmer who raises Indian corn wants a hand-sheller and cleaner. Even if he raises several hundred bushels of this kind of grain, most of which is shelled with a horse-power sheller, a hand-sheller is always eminently desirable for shelling a bushel or two for culinary purposes or for seed. Our best farmers understand and appreciate these suggestions, as they know that seed corn will keep better in the ear than if shelled; and Indian corn always makes better meal, better mush, corn bread, or anything else, if the grain is not shelled until the time has arrived when it is to be ground into meal. Then with an efficient hand-sheller, a person can shell out a few bushels in as many minutes. Besides this, if a farmer has a convenient hand-sheller, laborers can shell his entire crop of corn during rainy days or leisure hours, when no other labor could be performed.



The accompanying illustration represents the very best hand-sheller that is manufactured, at the present time, in the United States.

This sheller has been in use but a short time; yet for ease, rapidity, and efficiency of operation, it is acknowledged by competent judges to have no equal. Shellers may hereafter be invented that will excel this one, but it is doubtful whether anything will be brought out very soon that will equal it.

The shelling is done by means of a horizontal cylinder about nine and a half inches in diameter at the ends, and twenty-two inches long. The cylinder may

be made of wood, and spiral rows of small spikes driven into the surface, the ends of which extend above the surface about one-fourth of an inch; or the cylinder may be made, in sections, of cast iron, as these are usually made, and bolted to cast-iron heads at the ends and at the middle. The cylinders are eight and five-eighths inches in diameter midway between the ends.

The cylinder makes seven revolutions to one of the crank. The balance wheel on the journal of the cylinder weighs fifteen pounds. There are twelve rows of spikes. Every ear is dropped on a table at the side of the cylinder; and several pressers attached to springs made of coiled wire press the ears up against the cylinder. As the rows of spikes stand in a spiral direction, they work the cobs to the other end of the cylinder and drive them out of a hole in the side of the sheller, as represented by the illustrations. A small metallic door is hung on hinges at the upper side of the orifice. This arrangement prevents the shelled grain from being scattered over the floor.

After the grain is removed from the cobs, it drops down on an inclined sieve, which separates the heavy chaff from the corn and delivers the clean grain ready for use, or cleaned for market, in a measure or box.

This sheller turns exceedingly easy, and it will shell green ordry, large or small ears, with equal facility as fast as one person can pick them up and drop them into the sheller. There are other kinds of shellers that will shell as fast as this one, but they will not separate and clean the grain.

HORSE CORN SHELLERS.

There are several kinds of horse corn shellers, both east and west, which shell this kind of grain, and clean it also, with astonishing rapidity. In some instances, in the west, a corn sheller is driven by a steam-engine, and the fire is made of the cobs. For a number of years the corn was only shelled and separated from the cobs; but now, cleaners are attached, so that the clean grain is all delivered in bags or measures. Shellers of this kind are manufactured in most of the large cities of the west. Power shellers of an excellent style are manufactured by some one at Penn Yan, New York.

CIDER AND WINE MILLS.

As so much attention is being directed to the cultivation of small fruit, cider and various kinds of domestic wines, numerous inventors have brought out portable mills for grinding the fruits and expressing the juice.

Most people want a cheap, efficient, convenient, and portable mill with which they can make a gallon of cider or wine, or larger quantities if desirable. There are several kinds that operate satisfactorily; but I believe the little portable mill illustrated by the accompanying figure, manufactured by the Peekskill Plough Works, Peekskill, New York, and by George E. Hutchinson, Cleveland, Ohio, stands pre-eminently at the head of the list, when everything is taken into consideration. This mill will grind apples, pears, and grapes, without crushing the seeds, which is an important point when making cider or wine. It will also grind all kinds of berries and cherries, and crush the pits without injuring the grinding apparatus.

Apples are first crushed, then ground into a fine pomace, which is discharged directly into the curb or into a pail. The grinding may be done by hand or by horse-power. The pressing is done by hand. The teeth of the grinder are so

arranged that no apples can clog between them. One man can grind several bushels of apples per hour, and make several gallons of any kind of wine per hour. This machine can be employed as an excellent lard press; and it is frequently employed in the dairy for pressing cheese.

There may be better mills than this, but it has not been my good fortune to meet with any that possess that compactness, convenience, durability, and efficiency which are combined in this mill. The crowning consideration is its cheapness, which at present is about $22 for the small size. The same firm makes mills of a larger size.

ALLEN'S NEW WEEDING HOE.

Among the many improvements in garden implements, we have seen none that so well commends itself to every one having a garden to improve, as Allen's new weeding hoe, herewith illustrated. It somewhat resembles a garden rake with a cutting blade attached to the ends of the teeth. This blade lies flat upon the ground, and is toothed on the two edges and sharpened. By raising or lowering the handle, the blade enters the ground to the depth desired by the operator; and by shoving and drawing cuts off all roots; while at the same time the rake teeth pulverize the soil and tear out the weeds by the roots. The tool is light, well made, and is worked with remarkable ease and facility. It was invented by George P. Allen, Woodbury, Connecticut.

IMPROVED PERPETUAL BRICK AND DRAIN TILE KILNS.

A new era has commenced in the manufacture of bricks and drain tiles. Machinery for tempering the clay, moulding the brick, and forming the tiles is now as nearly perfect as we can devise. Suitable kilns have been needed; and a vast amount of money has been expended in experimenting in constructing kilns that would require less fuel to burn the bricks and the tiles, and at the same time burn all that were in the kiln with desirable uniformity. Hitherto a large percentage of bricks and tiles were injured by being burned too much, while a portion would not be burned enough.

During the past year Messrs. Cornish & Congdon, 175 Broadway, New York city, have invented a perpetual kiln for burning *bricks, tile, pottery-ware*, and also for drying *peat*, consisting of an inclined tunnel made of brick walls, in which a track is laid, and the bricks or tiles are passed through on cars or platforms by means of a gear wheel. From 2,000 to 10,000 bricks, according to the size of the kiln, are placed upon each car, in arches, the same as in ordinary kilns. The fires are placed about midway of the tunnel, and the bricks that are to be burned are gradually drawn down to them. In this way the water smoke is carried off by a gentle heat, and the bricks prepared for a greater and constantly increasing degree of heat until they are thoroughly burned. When this is done the cars are drawn below the fires and the cooling process commences, and is graduated the same as the heating process, all the heat from the cooling bricks passing up through the tunnel, and thus aiding to burn the green bricks.

There is also a second tunnel or chamber over the main tunnel, heated to a considerable degree by the burning bricks beneath, through which passes an endless belt, and green bricks laid upon this belt directly from the moulds are carried gradually through the heated air, and by the time they arrive at the upper end of the kiln they are sufficiently dried to be placed on the cars and burned.

The proprietors of this kiln state that this arrangement of a kiln saves manual labor, as the bricks or tiles have to be handled but once from the time they leave the moulds until they come out of the kiln burned and ready for market. It also saves time as well as the necessity of drying the brick on the yard, and subjecting them to the risk of storms, &c. Bricks by this process can be thoroughly burned and cooled in twenty-four hours. The average quality of the brick is also improved. The heat being equalized, the bricks do not crack nor check, and are *all* burned of a uniform hardness and color.

This is a desideratum which has been wanting ever since drain tiles were first manufactured. Untold numbers of drain tiles have been imperfectly burned. The consequence was that when laid in ditches, they soon disintegrated, obstructing the water-course, bringing draining land with tiles into disrepute, and thus preventing the beneficial effects of under-drains on the productiveness of wet land, simply for want of a suitable kiln for burning the tiles.

Farmers will hail this excellent improvement with unbounded satisfaction, as it will not only produce bricks and drain tiles of a uniform quality, but they will have far better articles at lower rates. Such brick kilns will be of immense value to all those portions of our country that can be improved by under-draining with tiles.

IMPROVED CHURNS.

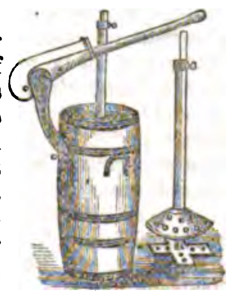
Perhaps few men have taken more critical observations touching churns than the writer, for the past twenty years; and I must say in all candor that a revolving churn, the Brinkerhoff churn, herewith illustrated, is decidedly the best churn that I have met with; and I think the experience of every unprejudiced dairymen who has used one of this kind of churns will coincide with my indorsement. It has been in use only a few years, but I have yet to learn of any instance in which this has been rejected for another revolving churn. The inventor, J. Brinkerhoff, Auburn, New York, and Hemming & Sparry, New York city, are the only manufacturers of it within my knowledge.

That part of the churn which agitates the cream consists of a round wooden journal in the centre of the box, having three systems of flat paddles, some five or six inches long, inserted into this journal like the spokes of a wheel. The paddles are about one inch wide and half an inch thick, and the flat surface on both sides is gouged out the entire length, so as to throw the cream or milk upward when the journal is revolved by means of a crank, cog-wheel, or pinion. There are larger sizes than the one here illustrated; and the churn can be worked by hand or attached to a sheep-power, or dog-power, or horse-power. Numerous experiments have proven that much less power is

required to churn ten gallons of cream with such a churn than with the old-fashioned dash churn, as the paddles are forced under the cream and throw it upward into the air. The crank may be turned either way when churning. Another important point is, every part may be cleaned with facility.

WESTCOTT'S IMPROVED DASH CHURN.

As many dairymen will not use any churn but one that operates on the dash principle, I herewith give a brief description and illustration of the best improvement in the dash churn that can be found in the country.



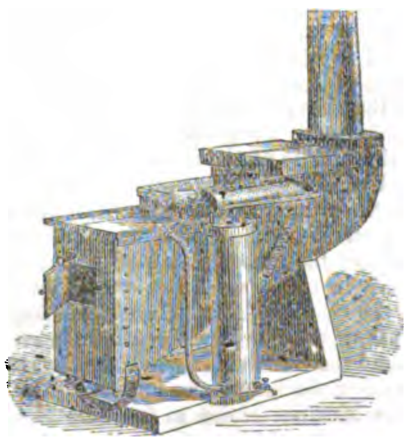
The illustration furnishes a correct idea of the churn. The dash is operated by a horizontal lever. A stiff spring is secured to the short end of the lever for the purpose of lifting the dasher after it has been forced downward, thus relieving the operator of the fatigue caused by lifting the dasher. Every one who is accustomed to use a dash churn understands that lifting the dasher constitutes the most laborious part of churning with a churn of this kind. It is true that more force is required to press the dasher downward, as the spring operates as a hindrance when the lever is descending. But it must be borne in mind that a person can press a lever downwards against a strong resistance with much less fatigue than he can lift a weight equal to the strength of a spring that will hold or lift a given weight or pressure.

At the right hand of the illustration the dasher is represented, having an adjustable flange-dasher, which may be moved up and down on the standard by means of a screw, the thread of which is cut in the standard and in the centre hole of the adjustable dasher. Many dairymen, who thought there could not be an improvement in the old dash churn, have accepted this churn as superior to any other.

H. P. Westcott & Co., Seneca Falls, New York, is the inventor and manufacturer.

YOUNGMAN'S EVAPORATOR AND REFINER.

The culture of sorghum for the manufacture of sirup and sugar has acquired a wonderful popularity in most of the States. Yankee ingenuity has made gigantic strides in perfecting machinery for evaporating and refining the juice. Cook's evaporator stood unrivalled for a while, but I believe, at the present writing, Youngman's, represented by Mead & Holmes, Rockford, Illinois, now stands without a successful rival. It has been approved by the most reliable authorities, and seems to be almost a national blessing. There is a peculiarly disagreeable vegetable tang to sorghum sirup when made with the ordinary evaporators, but Youngman's evaporator effectually overcomes this difficulty. Samples of sirup taken from the worst specimens of old, sour, unmerchantable sirups have been refined by this new evaporator and rendered fully equal to the first quality of sirup, having no taint or tang.



The accompanying illustration will furnish a fair idea of the evaporator, con-

sisting of four evaporating pans. Two of these pans nearest the smoke-stack are called the defecating pans. The pan in the middle is the evaporating pan; the one directly over the fire is called the finishing pan. Beneath the pans is a damper, by which the degree of heat can be regulated at pleasure. From the defecating pans the juice flows through a strainer into the evaporating pan. This pan still further refines the juice as well as evaporates it. Under one side of this pan is a cold-air chamber, over which the scum gathers, and whence it is removed by a beautifully operating crank skimmer. From this pan the juice flows through a filter containing granulated bone, black, where it issues through a pipe into a finishing pan. Here the heat is controlled by means of a register and cold-air chamber beneath. The heat is controlled so thoroughly that it may all be removed or be let on with great intensity, so that the finishing may be done with great rapidity, and at the same time all danger from burning may be avoided. From this evaporating pan the finished sirup flows in a continuous stream, perfectly purified and refined from all mucilaginous, gummy and objectionable substances, and equal to the best of refined sirups. It is then in the best possible state for granulation, being entirely freed from glucose. This evaporator is very light and portable, as it can be easily lifted into a lumber wagon and conveyed from place to place. The capacity of machine No. 1 is from eight to ten gallons per hour, and the consumption of wood is no more than an old fashioned box stove.

THE ORIGIN OF THE DOMESTIC TURKEY.

BY SPENCER F. BAIRD, ASSISTANT SECRETARY OF THE SMITHSONIAN INSTITUTE.

As with nearly all the animals which have been brought under domestication by man, the true origin of the common barn-yard turkey was for a long time a matter of uncertainty. As a well known writer (Martin) observes: "So involved in obscurity is the early history of the turkey, and so ignorant do the writers of the sixteenth and seventeenth centuries appear to have been about it, that they have regarded it as a bird known to the ancients by the name of *meleagris*, (really the guinea fowl or pintado,) a mistake which was not cleared up till the middle of the eighteenth century. The appellation of "turkey" which this bird bears in England arose from the supposition that it came originally from the country of that name—an idea entirely erroneous, as it owes its origin to the New World. Mexico was first discovered by Grigalva in 1518. Oviedo speaks of the turkey as a kind of peacock abounding in New Spain, which had already in 1526 been transported in a domestic state to the West India islands and the *Spanish Main*, where it was kept by the Christian colonists.

It is reported to have been introduced into England in 1541. In 1573 it had become the Christmas fare of the farmer.

Among the luxuries belonging to the high condition of civilization exhibited by the Mexican nation at the time of the Spanish conquest was the possession by Montezuma of one of the most extensive zoological gardens on record, numbering nearly all the animals of that country, with others brought at much expense from great distances, and it is stated that turkeys were supplied as food in large numbers daily to the beasts of prey in the menagerie of the Mexican Em-

peror. No idea can be formed at the present day of the date when this bird was first reclaimed in Mexico from its wild condition, although probably it had been known in a domestic state for many centuries. There can, however, be no question of the fact that it was habitually reared by the Mexicans at the time of the conquest, and introduced from Mexico or New Spain into Europe early in the sixteenth century, either directly or from the West India islands, into which it had been previously carried.

It has, however, always been a matter of surprise that the wild turkey of eastern North America did not assimilate more closely to the domestic bird in color, habits, and by interbreeding, although until recently no suspicion was entertained that they might belong to different species. Such, however, now appears to be the fact, as I will endeavor to show.

The proposition I present is that there are two species of wild turkey in North America; one confined to the more eastern and southern United States, the other to the southern Rocky mountains and adjacent part of Texas, New Mexico, Colorado, and Arizona; that the latter extends along eastern Mexico as far south at least as Orizaba, and that it is from this Mexican species and not from that of eastern North America that this domestic turkey is derived.

In the proceedings of the Zoological Society of London for 1856, page 61, Mr. Gould characterizes as new a wild turkey from the mines of Real del Norte, in Mexico, under the name of *Meleagris Mexicana*, and is the first to suggest that it is derived from the domesticated bird, and not from the common wild turkey of eastern North America, on which he retains the name of *M. gallopavo*, of Linnæus. He stated that the peculiarities of the new species consist chiefly in the creamy white tips of the tail feathers and of the upper tail coverts, with some other points of minor importance. I suggest that the wild turkey of New Mexico, as referred to by various writers, belongs to this new species, and not to the *M. gallopavo*.

In 1858, in the report on the birds collected by the Pacific railroad expedition, (vol. ix, page 618, of the series of Pacific Railroad Report,) I referred to this subject, and established the existence in North America of two species of wild turkey—one belonging to the eastern, the other to middle North America. Much additional material has since corroborated this view, and while the *M. gallopavo* is found along the Missouri river and eastward, and extends into eastern Texas, the other is now known to belong to the Llano Estæado and other parts of western Texas, to New Mexico, and to Arizona.

The recent acquisition of a fine male turkey by the Smithsonian Institution from the vicinity of Mount Orizaba in Mexico, and its comparison with a skin from Santa Fé, enables me to assert the positive identity of our western and the Mexican species, and one readily separable from the better known wild bird of the eastern United States. There is now little reason to doubt that the true origin of the barn-yard turkey is to be sought for in the Mexican species, and not in the North American, a hypothesis which explains the fact of the difficulty in establishing a cross between our wild and tame birds.

The presumed differences between the two species may be briefly indicated as consisting principally in the creamy or fulvous white of the tips of the tail feathers and of the feathers overlying the base of the tail and of the hinder part of the back of the Mexican and typical barn-yard birds, as compared with the decided chestnut-brown of the same parts in the eastern wild turkey. There are other differences, but they are less evident, and those indicated will readily serve to distinguish the two species.

The true wild bird of eastern North America always has the tips of the tail feathers and upper tail covert of a chestnut-brown color; the Mexican species and its descendant of the barn-yard never exhibits this feature.

Sometimes this domesticated bird is exactly like its wild original, differing only

in rather greater development of the fatty lobes of the head and neck, and of this an example may be seen in the museum of the Smithsonian Institution.

There is a variety of the domestic bird which is entirely black, sometimes even including the larger quills, which in both species are naturally banded with white, and in this there may be little or no trace of any bands at the end of the tail and of its upper coverts; but whatever may be the asseverations of the sportsman, the poultry-dealer or the farmer, as to the "wildness" of any particular bird, or what the circumstances attendant upon its capture or death by trapping, shooting or otherwise, implicit confidence may be placed in the test above indicated, namely: if the tips of tail and tail covert are chestnut-brown, the specimen belongs to the *M. gallopavo* or "wild turkey;" if the same part is either entirely black or any shade of whitish or light fulvous, then it is a "barn-yard" fowl.

The following extract from a letter written by M. Sartorius, the accomplished naturalist, to whom the Smithsonian Institution owes the specimen of the wild Mexican bird referred to above, will be read with interest:

"MIRADOR, STATE OF VERA CRUZ,
"*January* 20, 1867.

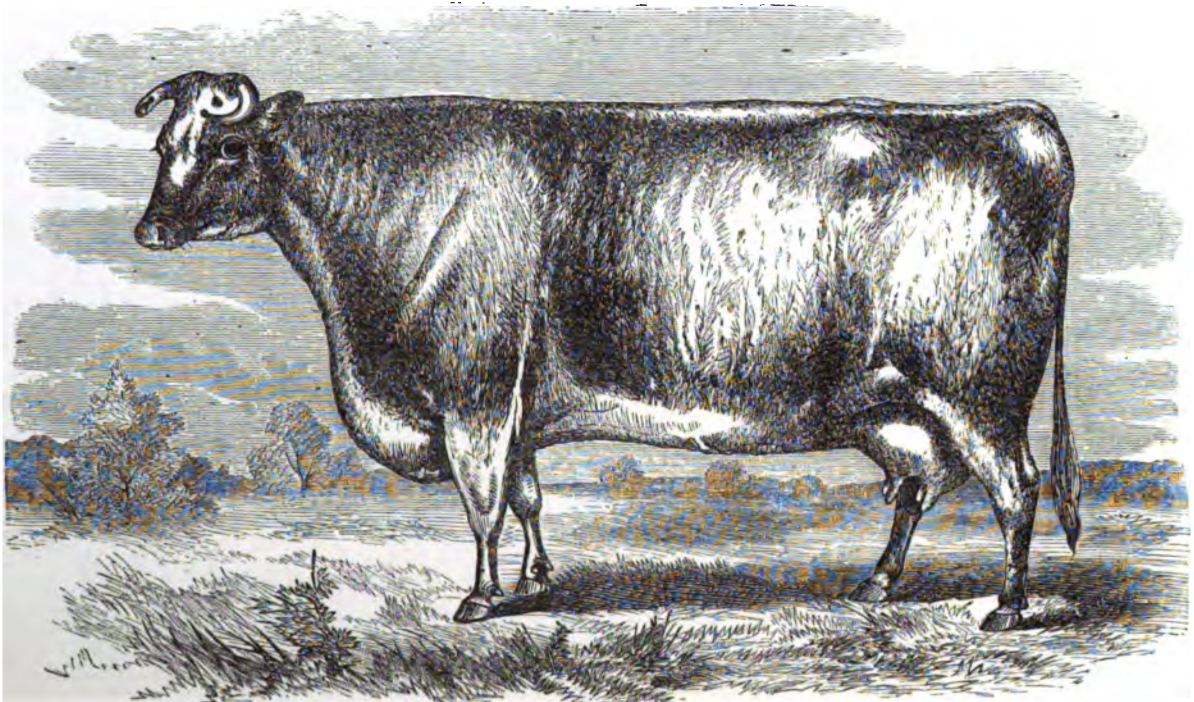
"I am entirely of your opinion in regard to the origin of the domestic turkey, as our wild bird differs from the tame only in the less amount of development of the fatty lobes of the head and neck.

"*Meleagris Mexicana* is tolerably abundant in this neighborhood, belonging more especially to the sparsely overgrown savannahs between the region of the oaks and the coast, the Tierra Caliente or 'warm region' proper. It is a very shy bird, living in families like the wild geese, and keeping sentinels on the watch whenever the flock is feeding in the vicinity of threatened danger. It derives its nourishment from plants and insects on the ground, and scratches with its feet to aid in the search for food. In running the swiftest dog cannot overtake it. It is not very fond of taking to flight, but its powers in this respect are not behind those of any of the allied forms. Its breeding season is in March or April, when the hens separate from the males to reunite into families again in September. Their general habits during this season are much as with the domestic bird, although I cannot say whether they inflate and swell themselves out in the same manner. I am, however, inclined to doubt it, as the specimen I have handled did not have the tips of the wing feathers worn away as in the barn-yard breed. The female lays three to twelve brownish red, spotted eggs in the high grain, and hatches them out in thirty days, as is the case with the tame turkey. The flesh of the wild bird is dry, but very sweet, like the tame fowl, and like the latter is dark on the back and legs, and white on the breast and wings.

"The white meat of the flesh on the breast of the Mexican and the tame turkey, as compared with the darker meat of the common North American wild bird, is a fact of importance to be taken into consideration.

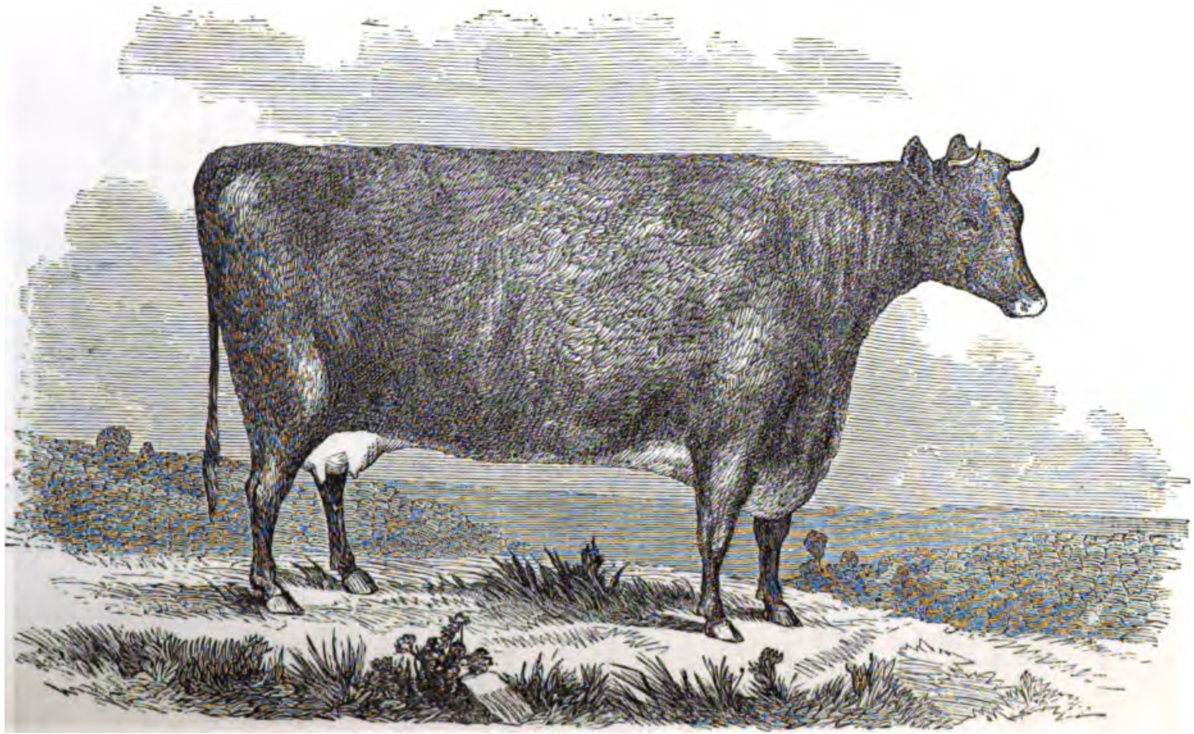
"The exact distribution of the Mexican wild turkey southward and westward is not ascertained, nor is it known that it occupies the western portion of the Mexican country. In Yucatan and northern Guatemala it is replaced by a third species, the ocellated turkey, (*Meleagris ocellata*) rather less in size, but far more striking in appearance, being marked in the tail with spots somewhat like the 'eyes' of the tail of the peacock. The three species thus belong to Mexico and northern parts of Central America."

PLATE XVI.



"CREAM POT" COW.

Property of William H. Slingerland, Albany, New York.



"CREAM POT" COW.

Property of P. W. Jones, Amherst, New Hampshire.

THE "CREAM POT" STOCK.

BY WILLIAM H. SLINGERLAND, NORMAN'S HILL, ALBANY, NEW YORK.

The original dam of the "Cream Pot" breed of stock was a large, light roan, short-horn cow, and her pedigree is as follows: Bred by H. & I. Carpenter, New York; got by imp. Duke of Exeter, 449 (10,152); dam, Cream Pot 7th, by Fontiac, 125; g. dam Cream Pot 2d, by Guazirone, 68; gr. g. dam Cream Pot, by imported Lord Althorpe, son of Firby (1,040;) gr. gr. g. dam Flora Hills, by Young Eclipse, son of imported Eclipse; gr. gr. gr. g. dam imported Jenny. "Lord Althorpe" was bred by Lord Althorpe, afterwards Earl Spencer, and got by Firby (1,040) out of his cow "Lady Althorpe." She gave thirty quarts of milk per day, for months in succession, shortly after calving, five quarts of which yielded eight and a half ounces of butter. The original cow, "Cream Pot," gave, when in her prime, thirty-six quarts of milk per day, and made eighteen pounds of butter per week, while the property of John F. Sheaf.

The "Young Eclipse" above referred to was got by imported "Eclipse" out of imported "Jenny," and both were imported by Henry Hills, esq., about the year 1820, on account of the milking qualities of the stock from which they were descended. The cow I first purchased of this breed gave, by actual measurement, from seventy-three to seventy-five pounds of milk per day, when fed on grass alone, from which was made twenty-three pounds twelve ounces of butter in ten days. She was awarded the first prize at the fair of the New York State Agricultural Society, in 1859, as the best milk and butter cow of any breed, and each of her descendants has taken the same prize in succession.

Thus this peculiar family of stock has been bred exclusively for milk long before their importation, and ever since their introduction into this country; and great caution has been exercised in selecting milking stock throughout all their line of descent. I have never seen a heifer of this kind of stock whose milk could not be readily distinguished, by the richness of its color, from the milk of any other kind of stock. I have been experimenting in this kind of stock for the last twenty years, and I am entirely satisfied with the result, as this breed combines fattening with its milking qualities, and I have never known one of the old cow's progeny that was not, at any season of the year, on ordinary feed or pasturage, fit for the shambles. The idea in this country generally is, that the short-horns are not generally good milkers, from the fact that many of the breeders have been experimenting for fattening qualities, size, and beauty, with little, if any, regard to milking qualities, and this is especially the case in the western States, where stock-raising for beef is very remunerative.

But while this is true of many families of short-horns, there are others which have been bred solely for the dairy, and it long since occurred to me that if we could find a cross that would combine both of these essential qualities, it would be just what is wanted by the farmer of the eastern and middle States.

With all the culture which the improved short-horns have received, it has taken nearly a century to get the milking qualities of the "Cream Pot" breed, and, at the same time, they are quickly prepared for the shambles. Their general appearance is as follows: The head short and fine, broad across the eyes, but gradually tapering to the nose; the nostrils full and prominent; the nose itself of a rich flesh color; eyes bright and placid; ears small and thin; horns small and thin, and very much curved. The head is well set on a thin and

somewhat drooping neck. The chest not very extensive; shoulders high, fine, and well formed; fore legs short and very thin; barrel round, broad, and very deep, with extraordinary milk veins below the barrel, which is very wide and level on the back, straight from the shoulders to the tail; the udder is broad and flat, with the teats set wide apart. They are very hardy, have strong constitutions, and are good feeders.

The importance of these points is not sufficiently regarded by the dairymen and farmers of this country; but I think I can discover a great change, in the last few years, in the public opinion on this subject. It is generally conceded that every householder desires a good milch cow for his family use; and while all may desire beef, no family can dispense with the use of milk and butter, and, therefore, it becomes a subject of great importance to almost every individual in the whole community, whether farmers shall improve our stock, or continue to breed from degenerated animals.

THE JAQUES "CREAM POT" STOCK.

BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

THE native stock of New England has occasionally produced milkers scarcely to be excelled by the best of any breed. Well authenticated statements of excessive quantity of milk or cream products, or both, could be adduced in illustration. The early importations often included some of the best specimens of English or Dutch dairy stock. Many farmers, holding practical and sensible views of breeding, with little knowledge of its scientific principles, have maintained the high character of their stock, and even essentially improved its dairy qualities.

Thirty years ago, Mr. Samuel Jaques, of the Ten-Hills Farm, Charlestown, Massachusetts, had attained very satisfactory results in his efforts to establish a breed of dairy stock, founded on crosses upon selected native stock, by a short-horn bull belonging to a family famous for perpetuating milking qualities. Mr. P. W. Jones, the owner of the cow herewith pictured, says that the original cows were two selected by Mr. Jaques, after months of search, and purchased from a Mr. Lawrence, of Groton, Massachusetts; that they were of Danish origin, one a "large milker," the other "an extremely fine butter cow;" and that he kept the two branches distinct, preserving thus a "milking strain and a butter strain." The bull Cœlebs, a short-horn, was the sire of the race. Mr. Jaques was firm in the belief that he could breed to order, with positive certainty, any peculiarity or improvement desired. In this he was, doubtless, too sanguine.

Mr. Henry Colman, in his official report as commissioner for the survey of the agriculture of Massachusetts, says: "The dam of this stock was a noble-sized cow, raised in Groton, Massachusetts; but the owner knew nothing particularly of her origin. She was sold to a gentleman by the name of Haskins, residing in Dorchester, about five miles from Boston; and her cream was of such extraordinary richness that it would become separated into butter by the motion of the carriage in bringing it into the city. The stock owned by Mr. Jaques is descended from this cow by a cross with the improved Durham short-horn bull Cœlebs, imported, some years since, by a gentleman of that city, and owned afterwards by Mr. Jaques. This bull was without a pedigree; but it is said

that there is good reason to believe that he was a regular descendant from Mr. Collins' celebrated bull "Comet." He further says: "I have repeatedly seen cream from these cows, and its yellowness and consistency are remarkable; and, in company with several gentlemen of the legislature, I saw a portion of it converted into butter, with a spoon, in one minute. The color of Mr. Jaques' stock is a deep red, a favorite color in New England. They are well-formed, and thrifty upon common feed; and, if they continue to display the extraordinary properties by which they are now distinguished, they promise to prove themselves, for dairy purposes, the most valuable race of animals ever known among us; and as remarkable as any of which we have any information."

The following statement was made by Colonel Jaques himself: "It has been my object to effect such an improvement in milch cows as should produce the greatest quantity of rich milk, affording the largest quantity of butter. There is a greater difference, in pecuniary profit, between a good and a poor cow, than among any other domestic animals. In some yards there may be found those which will not produce more than three pounds per week, and others that would make nine, and all on the same keep. As we sometimes hear of cows which have produced seventeen pounds of butter per week, and even more, it occurred to me to inquire why a breed or race could not be formed with the same valuable properties. This I have attempted, and have carried it to the third generation, and I am confident of success. I have a cow whose milk has produced nine pounds of the best butter in three days; and this on grass feed only. This I call my Cream Pot breed. I have bred my Cream Pots with red or mahogany-colored hair, yellow noses, with mahogany-colored teats, yellow skin, silky and elastic to the touch. I have obtained the breed by the cross of a Durham short-horned bull on a selected native cow, with certain extraordinary points and properties, anxious to retain as much of the form of the Durham as to insure capacious udders, and with the valuable property of affording rich milk. Though an admirer of the Durham short-horns, I have not found them producing so rich milk, nor making so much yellow butter, as I could wish. The Durham race are round and straight in the barrel, full in the twist, and inclining to be thick in the thigh. I have wished for some improvement in the form of the bag. Generally, cows, which I have examined, giving the largest amount of the richest milk, have had capacious bags, full behind, extending far up into the twist, and also well formed, hanging moderately deep when full of milk, and after the milk is drawn, quite the reverse, for I would avoid a fleshy bag. My Cream Pot breed are full in the body, drop deep in the flank, are not quite so straight in the belly, nor as full in the twist, nor as thick in the thigh; but in other respects I wish them to approach the Durham as near as may be. My Cream Pot breed excel particularly in affording a great quantity of rich cream, and that cream capable of being formed into butter in a short time, and with little labor, leaving a small proportion of buttermilk. Their cream produces more than eighty per cent. of pure butter; and it is not unfrequent to form the cream into butter in one minute. It has been done in forty seconds. I have a heifer, designated as Betty Cream-Pot, one of the third generation, which produced her first calf at two and a half years old. Mr. Brown, my foreman, made the following experiment upon her milk, without my knowledge at the time: After milking, he took two quarts of her milk out of the pail, and, having strained it into a pan, allowed it to stand twenty-four hours. Having then skimmed the cream into a bowl, he churned it with a tablespoon, and in one minute, by the clock, he formed the butter. It was then pressed and worked in the usual way, and amounted to half a pound of pure butter. After this, the following practice was pursued for eight or ten weeks in succession: At each of four successive milkings, two quarts of the strippings were strained into a pan, and then churned. The average time of churning did not exceed ten minutes; in some instances the butter was formed in five minutes. After being properly worked over it was weighed, and never

fell short of two pounds. The remainder of her milk was for family use, and, when set for cream, produced the usual quantity. These experiments were made on grass feed only. She did not give a large mess; only about twelve quarts per day. I have forty cows and heifers, ten bulls and bull calves, of different grades, of this Cream Pot breed, all bred and raised by myself. I keep my bulls, selected as breeders, until I have proof of the quality of their offspring. My old Cream Pot bull is ten years old. My Don Cream Pot, from which I am now breeding with some of my cows and heifers, is three years old."

Mr. Jones has the last two heifers and the last two bulls bred by the late Colonel Jaques, and professes to hold this Cream Pot blood as pure as it came from its originator. He thus describes the stock: "They are of medium size, with straight backs, long bodies, deep briskets, broad hips, short legs—as Colonel Jaques used to say, *one-story cattle*. They have small tails, broad heads, long from eyes to end of the nose; eyes large and well opened; bags well set forward, and, when milked, nothing but a thin velvet skin, and invariably the forward teats the longest and largest. They are not a close-ribbed-up cattle, like many other breeds, but have flat ribs, very open, like the joints of their backs; color light red generally, with a circle round the eyes, and muzzle a shade or two lighter than the body; disposition mild and gentle. I have never known a kicker or an unruly one of the breed."

In a volume of the "Agriculture of Massachusetts," mention is made of a Cream Pot and Durham cow, owned by Harvey Dodge, of Sutton, Massachusetts, which gave thirty-seven pounds of milk per day, from June to October, on grass alone.

The establishment of an American breed, commencing by judicious selections of the heaviest native milkers, and careful breeding with short-horn bulls of families of established reputation as dairy stock, should suffice to satisfy the ambition of any enlightened breeder in the country. It would be the work of a lifetime, however, and few have either the skill or the patience for such a work.

IMPROVEMENT OF NATIVE CATTLE.

BY LEWIS F. ALLEN, BLACK ROCK, NEW YORK.

To properly understand the subject in its several bearings, it is necessary that the past history and present status of our American cattle should be explained to some extent.

The first cattle introduced into North America were brought to the coast of what is now Mexico by the Spaniards. They came from Spain and the Spanish West Indies, and were landed probably at Vera Cruz, as early as the year 1525. In the mild climate and on the abundant pasturage of that country they thrived and spread with the increase of the population, and in the course of years ranged over the country, in both domestic and semi-wild condition. They have so lived and increased to the present time. Of what particular kind or breed the cattle were it is now impossible to say, but they were no doubt of the same race as those long bred and kept by the Moors in Andalusia and the south of Spain, and, after the expulsion of the Moors from the country, retained by the Castilians, and continued by them till after the discovery of America, and probably to the present day.

The same race of cattle still exists in Mexico and its several provinces, and is now the chief stock of New Mexico, Texas, and California. Their qualities will be noticed hereafter.

In the year 1608 Quebec, in Lower Canada, was first settled, and the surrounding country was peopled by emigrants from western France, who brought over with them cattle from Normandy, a small race, and noted for their kind domestic qualities. In that cold climate they received care and protection, and proved a highly useful breed.

In the year 1607 Virginia was first settled, on the James river, by a colony from England. Again, in 1609, another colony came over, and in 1610 and 1611 cattle were brought there from the West Indies. The colony was nearly destroyed by the Indians in 1622, but whether their cattle shared the fate of the colony is not accurately known. The survivors, however, received accessions from England soon afterwards, with cattle of the same stocks, probably, as those subsequently brought into the New England colonies. Of what care they received, or how rapidly they multiplied, we have no account; but, in all probability, by natural increase and frequent importations, the wants of the settlers were tolerably supplied. The climate was mild, wild forage abundant, and we may presume they thrived apace and spread with the necessities of the population.

The Dutch emigrants first settled New York in the year 1614, and brought with them cattle from Holland, of a different race from either of the others above mentioned. They were noted as good milkers, and black and white, and red and white, in colors. They also multiplied by natural increase and continued importations until the further supply from Holland was unnecessary.

In the year 1624 the English colonies, then settled at Plymouth and Boston, in Massachusetts, made their first importations of cattle from England. The mother country, at that day as now, possessed several different breeds. Of what breeds these early importations were we have no distinct knowledge. It may be supposed that they were gathered from near the localities whence they were shipped, and of the breeds then prevailing in the countries from which the emigrants proceeded to this country.

New Jersey was settled in 1624 by the Dutch, and Delaware about the same time by the Swedes, the settlers bringing cattle with them. The early records of New Hampshire show that cattle were imported into that colony in the years 1631, 1632, and 1633, from Denmark, with many Danish emigrants, who settled on the Piscataqua river. These Danish cattle were large, coarse in shape, and of a yellowish or dun color.

In 1633 Maryland was settled by English, and with Catholics under Lord Baltimore, who brought cattle from England and Ireland. North Carolina and South Carolina were settled in 1660 and 1670 by the English, and Pennsylvania in 1680, the settlers bringing their cattle from England.

It thus appears that the original stocks of cattle brought into the colonies were mainly English, with the few exceptions made by the Dutch, Danish, and Swedish importations, and perhaps a few French cattle introduced by the Huguenots into South Carolina, and possibly by some of the Huguenots who early came into New York. These cattle spread along the coast and into the interior, with the colonists, and as the latter intermixed their settlements, their herds became intermixed also, and in time made up that *conglomerate* race which has since spread throughout the United States, and is now known as "native cattle."

Ingenious efforts have been made by occasional American writers on cattle to identify some of the present native stocks with the original breeds of England, by their resemblance, more or less, to them, and thus claim them as direct descendants of such breeds; but that descent has been too remote, and the originals too uncertain in *legitimate* breed, to prove any certainty in the matter. We may well suppose, however, that Devons, the Herefords, the Long-horns, the Short-horns,

the Alderneys, and the polled or hornless cattle of Sussex and Norfolk, all of England, as well as the black and white belted cattle of Holland, and others less distinct in breed, came over; and as these emigrating cattle were confined to the localities near which they were first landed, they doubtless perpetuated their qualities and appearance among their descendants more strongly than in other districts where they were miscellaneously bred, and without regard to distinction in appearance or race. Some of the colonists were more painstaking than others, having a fancy for shape, color, size, and dairy qualities, and hence bred in their stock with care, to perpetuate their desirable qualities through their descendants. The New England people were rather famous for this. They worked oxen largely on their rough and strong land, and those colonies and States for nearly two centuries were the chief cheese-producing localities of the country. The "red cattle" of New England were sometimes claimed by their advocates as of a distinct breed, but without sufficient evidence that they were entitled to such merit; their superior qualities only showing that good husbandry had developed them to a higher degree than that attained by others of the same original stock, which had been neglected, or in the breeding and rearing of which less discriminating care had been used.

Bred through every possible degree of intermixture from Maine to Georgia, and far into the interior, so far as the extending settlements progressed, our native cattle have ranged, better in some States and worse in others, according to the care and keeping received, and they are now found an indefinitely mixed race, without blood or pedigree other than that which may be traced to a source common with all.

As the colonists increased in prosperity, history gives us some vague information, and local tradition supplies other accounts, of individual importations in the last century of cattle of some particular breeds for the purpose of improving our domestic stock.

But *these* breeds were not preserved in their purity, and after some years of trial they were lost in the *grade* blood of their descendants, and only recognized as an occasional resemblance to the original blood would "crop out" in a subsequent generation.

Our cattle history, thus vague and indefinite, brings us down through the last two centuries to the year 1793, at which time it was not known that a single herd of any distinct, improved foreign breed existed in the United States.

THE INTRODUCTION OF PURE FOREIGN BREEDS OF CATTLE.

In the year 1793, as near as can be ascertained, a Mr. Miller, of Virginia, and a Mr. Gough, of Baltimore, imported some cattle from England, which, from all the accounts we have had of them, were pure short-horns. Into what particular part of the country they went we are not advised, but our inference is that some of the blood was soon taken to the south branch of the Potomac river, in Virginia, a fine grazing region, which for many of the early years of the present century was noted for its superior cattle. As early as 1797 a Mr. Patton, from Virginia, took some of these short-horns into the blue-grass region of Kentucky, where they were afterwards known as the "Patton stock." They were there bred, and became decided favorites with the breeders and graziers of that young State.

In 1815 or 1816 a few short-horns were imported into ——— county, New York. In 1818, and down to 1824, several importations of short-horns were made into Massachusetts, New York, Pennsylvania, and Maryland, and it was then that these various importations began to be separately and distinctly bred. For more than a century they had maintained a distinguished character of superiority over some of the old breeds in England, and were owned and bred by men of enterprise, who had bestowed great care in their selection, with a view to developing

the valuable properties, both in flesh and for the dairy, which they possessed in an eminent degree. They had been cultivated for several centuries in three of the northeastern counties of England—Northumberland, Durham, and York—and the most sedulous care taken to transmit their blood in its greatest purity. These facts being known to the American importers, impressed them with a necessity, hitherto unappreciated here, of preserving the purity of blood, and, as evidence of it, the pedigree of their herds.

In the year 1817, an importation of three bulls and three heifers of the short horn breed was made by Col. Lewis Sanders, of Lexington, Kentucky, followed soon after by a bull and heifer, imported by a Captain Smith, of the same place. These were interbred among themselves, also into the Patton stock, and so laid the foundation of many valuable Kentucky breeds. After the year 1824 but few importations of short-horns were made, although those which had been previously brought out were carefully bred, and made their way successfully into various parts of the country. The States west of the Alleghanies, particularly Kentucky and Ohio, had then become largely engaged in cattle-breeding, and their fat cattle had been driven over the mountains in great numbers to the eastern markets; the attention of the breeders and graziers had become aroused to the importance of cultivating a better stock than they had previously possessed, but they could find no immediate means at home to meet the necessity. Hence, in 1834, the first combined and vigorous effort was made (in the Scioto valley of Ohio) to secure an importation that would supply the long-sought material for the improvement of the blood of their native breeds. In that year an agent was sent out by an organized association, and nineteen head of the best short-horns that could be obtained in England were brought over. In the immediately succeeding years, two other importations were made by the same company. These were followed by other importations, by individuals and associations in Kentucky, Pennsylvania, New York, and other States, down to the year 1860; so that, in these forty odd years, several hundreds of the best short-horns to be found in England have been brought into the United States—all of approved blood, and with distinct pedigrees, showing their lineage for generations, even centuries back.

It may appear invidious to thus distinguish the short-horns as the only approved foreign race of cattle to which the attention of our enterprising cattle-breeders had been aroused. But the object of this paper precludes any extended or particular notice of other breeds. In common justice, however, to the great cattle interests of the country, I must briefly allude to them. About the year 1816 two pairs of Hereford cattle were imported by the distinguished Kentucky statesman, Henry Clay, and taken to his farm at Lexington. A year or two afterwards, a pair of long-horn cattle were imported into the same State. But no particular results followed this introduction, and they were soon afterwards lost in the more absorbing blood of the short-horns. Many Devons were soon after imported into Maryland, New York, and New England, some Herefords into Massachusetts, and two considerable herds of the latter into New York and some into Canada; scattering along in time, also, Ayrshires for dairy purposes, together with the Dutch or Holsteins, Alderneys for their rich, yellow milk, cream, and butter; and last of all, the black Galloways from Scotland (famous for their excellent beef) into Canada. These are all good breeds, celebrated for their various qualities for both flesh and dairy use, and by their crosses on our native cattle the quality and value of the latter have been greatly improved.

The short-horns, however, in their superior size, compactness of frame, symmetry of form, rapid growth, early maturity, and imposing appearance, have acquired a wider popularity for their great beef-producing qualities than all the others put together, although the possessors of some of the other breeds challenge a rivalry of their own favorites as beef-producing animals, on equal *economical* grounds, and proportionate expenditure of food. The question of their compara-

tive merits, however, forms no part of the present discussion. It is simply the value of the *short-horns* in benefiting, by their crosses, the native cattle of our country, particularly in the great stock-producing States and Territories of the west.

THE VALUE AND IMPORTANCE OF OUR NEAT CATTLE.

This subject is most important in view of the vast interest connected with it, and its extent will now be considered. According to the census of the year 1860, the neat cattle of the United States and their Territories were: cows, 8,728,862; of working oxen, 2,240,675; of other cattle, 14,671,400; in all, 25,640,937. The value of these cattle may be estimated, at present prices, as follows:

Cows, at $40 each	$349, 154, 480
Oxen, at $50 each	112, 033, 750
Other cattle, at $25	366, 785, 000
Total	$827, 973, 230

"Other cattle" includes all under three or four years old, and as many of them are steers, intended for beef, the average price is not too high.

As I am not now estimating any quality in these cattle, except for the production of beef, and as the beef-producing States and Territories lie at the west, where it can be more cheaply and readily grown than in the middle and eastern States, I give a table of those States and Territories, with the cattle of the census of 1850 and 1860, to show the relative increase in their neat stock in ten years:

States.	Milch cows.		Working oxen.		Other cattle.	
	1850.	1860.	1850.	1860.	1850.	1860.
Arkansas	93, 151	158, 873	34, 239	70, 914	165, 320	318, 35[illegible]
California	4, 280	198, 859	4, 780	31, 527	253, 599	952, 0[illegible]
Illinois*	294, 671	532, 731	76, 156	90, 973	541, 209	891, 97[illegible]
Indiana*	284, 544	490, 033	40, 221	95, 982	389, 891	[illegible]
Iowa*	45, 704	188, 546	21, 892	56, 563	69, 025	281, 14[illegible]
Kansas*	....	26, 726	....	20, 133	....	41, 000
Kentucky*	284, 475	269, 215	62, 274	108, 999	442, 763	457, 84[illegible]
Michigan*	99, 676	200, 635	55, 350	65, 949	119, 471	267, 6[illegible]
Minnesota*	607	40, 386	655	27, 574	740	51, 04[illegible]
Missouri*	230, 169	345, 243	112, 168	166, 588	449, 173	657, 15[illegible]
Ohio*	544, 499	696, 309	65, 381	61, 760	749, 067	901, 79[illegible]
Oregon*	9, 427	53, 072	8, 114	7, 426	24, 188	93, 0[illegible]
Tennessee*	250, 456	247, 105	86, 255	104, 495	414, 051	408, 57[illegible]
Texas*	217, 811	598, 686	51, 285	172, 243	661, 018	2, 733, [illegible]
West Virginia	106, 000	110, 210	30, 000	33, 000	223, 000	200, 00[illegible]
Wisconsin	64, 339	193, 996	42, 801	93, 660	76, 293	225, [illegible]
Nebraska	....	7, 125	....	12, 720	....	8, [illegible]
New Mexico Territory	10, 635	34, 461	12, 557	26, 104	10, 085	[illegible]
Utah Territory	4, 861	13, 052	5, 266	9, 903	2, 489	17, 3[illegible]
Washington Territory	....	10, 034	....	2, 777	....	16, 0[illegible]
Total	2, 508, 305	4, 414, 697	709, 394	1, 259, 320	4, 591, 320	7, 134, 611

* Estimated at one-third of the original State.

I have not taken the middle, eastern, or planting States into account, as they show little increase of cattle, and as there is much more consumption than increase in them, beef-making is only incidental, in fattening such as are no longer fit for the dairy, or for work. Arkansas, Tennessee, and Texas have been placed in the list of cattle-growing States, although they are, to some extent,

planting States; but large portions of their lands are stock-growing, for export as well, and may be classed with the others.

The large percentage of increase in the new States and Territories within the last ten years, will be observed, and a considerable, indeed the main part of it, in the newest of them, has been made by emigration from the older States. The average increase in the whole number, in 1860, is over sixty per cent. of the returns of 1850. The enormous increase of the Texas returns of "other cattle," if correct, cannot be accounted for by natural production, and could only arrive by emigration from the Mexican border. I think there must be some error in the return, if there has been no emigration of stock, although the figures are *possible* in a country enjoying so mild a climate and such abundant pasturage. The fair basis on which to calculate an increase is the number of cows, and in a stock-growing country, allowing the cows to produce eighty per cent. of their number annually—a moderate calculation—and two-thirds of these calves to be reared, the annual increase may be thus stated:

INCREASE OF OUR NEAT CATTLE.

Discarding fractions, there were, in 1840, in the States and Territories named, 4,000,000 cows, which, at eighty per cent. annual increase in calves, (leaving off fractions for casualties,) would make 3,000,000. Two-thirds of these, reared, would be 2,000,000; so it will be readily seen that the increase in ten years, in a country where the husbandry is so largely devoted to cattle as in these western prairie States, would be enormous, as is shown in the newer States and Territories set down in the foregoing table; and as the new country beyond the Mississippi and Missouri rivers is chiefly prairie, with abundant herbage, where cattle can range for a great portion of the year without winter forage, their increase will probably be greater than in any of the older States east of the Mississippi. In fact, the capacity of our whole country for producing cattle has not yet been tested fully, and the year 1860 is about the time when the production may be said to have fairly commenced in a largely increased ratio. Since then, Kansas, Minnesota, Nebraska, Utah, Colorado, Dakota, Oregon, and Washington, have really begun to be settled, and cattle have not yet been taken there in numbers at all commensurate with the wants of the people for domestic use, to say nothing of a surplus for breeding.

It may be said that the late war has stopped the increase of our neat stock. This may be so in the States over which the hostile armies ranged; but I hazard the opinion that the other States and Territories named will show an increase, in 1870, equal to that of 1860 over 1850. We are, in fact, just beginning to get a glimpse of the vast resources of the West for cattle-production. Those broad savannas beyond the Missouri river, until recently supposed to be nothing but arid plains destitute of water and nutritious grasses, are found, to a considerable extent, to abound in the best grasses, with streams running over the surface and water accessible by boring to no great depth, and capable of supporting herds innumerable.

The great buffalo ranges contain untold millions of acres where the nutritive qualities of the grasses are not injured by frost, and are capable of supporting cattle, as well as the buffalo, the year round. That this wide region must be mainly a cattle-growing country is evident, owing to its great altitude, which does not permit Indian corn to grow to any extent; and of other grains, only wheat, oats, and barley, and then only in certain favored spots, by means of irrigation, always an expensive and laborious process.

It is true that hostile Indians and the buffalo may retard the settlement of those vast plains, but these obstacles will rapidly disappear before the grand march of civilized industry. The telegraph poles are already planted there; emigrant, passenger, and traffic trains have taken permanent possession of the

route over the plains; the great Pacific railway, tapping it on both sides, is making rapid progress in construction, and in less than five years its locomotives and trains will be daily thundering over the line; and at no distant day, its various branches will be threading every mountain valley and considerable water-course between the Rocky mountains and the Sierra Nevada, reaching the innumerable mines, and the hundreds of towns and cities scattered among them.

Our national territory is now measured on so vast a scale that any intelligent mind, looking over the map from one ocean to the other, and considering the diversities of climate, will see at a glance that important subdivisions of labor must ultimately take place in prosecuting our agricultural industry. East of a line drawn north and south five hundred miles west of the Mississippi, will be the land of cultivated crops, cotton, grains, and grasses, in a mixed agriculture. The great plain thence to the Rocky mountains will mostly be devoted to stock growing, as will also the great basin west to the Sierra Nevada. California will be devoted to mixed farming; as the hill and mountain lands of Scotland grow their cattle, which are annually driven to the lowlands and to England, on a diminutive scale compared to our extended capabilities, so, in time, will these plains grow their herds, to be transported to the richer grain regions east and west for feeding and consumption. Cheap and ready intercourse will promote this division of industry and aid its prosperity. The States east of the Rocky mountains, after supplying their own wants in beef and dairy products, will send their surplus abroad. The extreme western States will export their beef surplus by the way of California and the Pacific ocean to China, and the furthest Indies.

The rural population of the great western plains and the central basin will be composed chiefly of herdsmen, and their main occupation that of grazing cattle. We have seen that the soil and climate are better fitted for that pursuit than any other. The mining population which is to exist among them will, for many years, consume all other products which the farmers may have to spare, besides taking a great many of their cattle. Let there be peace throughout our borders and no foreign war to disturb our industry, and it is safe to predict that the census of 1870 will give the United States and Territories forty millions, and that of 1880 sixty millions of neat cattle within their limits.

PRESENT CONSUMPTION OF BEEF CATTLE IN THE UNITED STATES.

It is impossible to arrive at anything like accurate data in this matter. The census returns give no account of the number of beeves slaughtered in the United States. The city of New York, and its immediate suburbs, averaging a population of, say 1,200,000, with its shipping and various accessories, received for the year 1866, according to its market reports, about 6,000 beef cattle per week, amounting in round numbers to 312,000 head for the year. Supposing the present population of the United States to be thirty-eight millions, (as, according to the *estimated* census of 1870, it will then be rising of forty-two millions,) and allowing that the population of New York and its environs consume double the average quantity of beef required for other portions of the country, by reason of so much more *fresh* meat being consumed in the city than by the country population generally, the annual number of beef cattle slaughtered would be 4,940,000—say five millions in round numbers. This is probably not far out of the way, as the whole number of neat cattle now in the country (1867) may be estimated at thirty-six millions. One-seventh of the number may be slaughtered annually for consumption, and another million go for casualties, accidental deaths, disease, &c., giving an average life of seven years to the stock, which is also not far out of the way, as beef cattle are generally slaughtered at from three to five years old, and cows and working oxen may average full ten years before fed off for the shambles.

The New York Tribune allows the average weight of the beef—the four quarters only being estimated as weight in that market—at 750 pounds to each

animal, worth, in 1866, 15 cents per pound. This would make the value of the 312,000 cattle in New York thirty-five millions of dollars, the hides and tallow being thrown in or not estimated outside of the price paid for the meat, giving an average value to the cattle of about $112. From this deduct, say $23, average cost of getting them to market, and it leaves $90 as the average value of each beast at home.

It will not do, however, to place so high a value per head, individually, on all the cattle annually slaughtered. It must be recollected that *most* of the heaviest, as well as some of the lightest, cattle go to New York and other seaboard markets, and the *very* lightest, poorest, and youngest are mostly slaughtered at home, or in the immediate neighborhood where grazed and fed. The rule generally applied to fair beef cattle in the seaboard markets is to estimate the weight of the *five* quarters, as they call them, in beef animals, at three-fifths the live weight. Thus, if the four quarters, as estimated in the Tribune reports, be 750 pounds, the hide and tallow, or fifth quarter, added would swell the live weight to 1,250 pounds, which would be 10 cents a pound all round for meat, hide, and tallow.

Now, taking the 5,000,000 cattle annually slaughtered throughout the country at 1,000 pounds each, *live weight*, and allowing three-fifths of that weight to make the five quarters of beef, hide, and tallow, it would give 600 pounds each; estimating this 600 pounds at eight cents *home* value, we have $240,000,000 as the annual product of our stock in beef alone. It may be said that these are war prices, arising from an inflated currency, and so on, but they are the *current* prices of the day, and although they may fall when other commodities do, the estimate is fair, with other things.

If I were going into an estimate of the *entire* annual production from our neat stock, the dairy products and labor of the working oxen would come in for a share of credit, but as their *flesh* production is the only subject of the present discussion, attention will be confined to that alone.

We have seen that as our herds are now constituted they are made up of all qualities, good, bad, and indifferent, some very good, others execrably bad, almost worthless so far as any *profit* is connected with their breeding or rearing. All this may be improved by the use of bulls of better breed. It has been so done, and too long practiced by good stock-growers to admit of doubt or argument, and our stock-growers will never arrive at the maximum of profit in their business until a radical change in this regard is adopted.

INCREASE OF WEIGHT IN OUR CATTLE.

It is estimated by the most experienced stock-growers of our country—men who have been engaged in the vocation for forty years of their lives, and handled and kept cattle of every description—that *at least* 200 pounds can be added to the profitable or consumable weight of every steer or bullock at three and a half to four years old, when fairly fitted for slaughter. In other words, if the average weight now of a fair beef animal be 600 pounds, it may just as easily be made 800, and with no more expenditure of food, and but a small increased expense to the producer. This is asserted as *a fact*. I believe it, and so believing, shall proceed to its demonstration.

I desire to start fair, not as the champion of the *exclusive* value of one breed of improved cattle over all others, for I consider them all to have their peculiar values or merits, according to circumstances; but as the short-horns are the breed selected for this discussion, they only will be considered in explaining the present mode of improving our native cattle for *beef* purposes. We have seen that the short-horns have been in the United States for fifty years. They have been imported in much greater numbers than all the other foreign breeds put together, and are more widely known, and have acquired a greater popularity, than

any others. They have become acclimated, and are healthy, thriving on common food equally well with our native cattle. They show no signs of deterioration with us, but on the other hand, if possible, they improve. They are a stock or race of cattle having their distinctive qualities thoroughly established within themselves, and capable of imparting these qualities strongly into every other race with which their blood may be commingled. To make my argument conclusive, and divest it of all partisanship or unproved assertion, I shall give a brief history of the race, so far as it can be gathered from the most accurate English authorities. I consider this necessary in order to establish the fact of their long-inherited and distinct blood, which gives it a *certainty* of transmitting its qualities with far greater strength than if it were an aggregation of the blood of different races, or breeds recently made up, and which, in its progeny, would scatter into all the various strains of blood of which it was composed.

PRETENDED HISTORY OF THE SHORT-HORNS.

In giving a history of the short-horns, I am embarrassed by the existence of a wide-spread falsehood respecting that history, which has obtained credit by aid of almost all our popular agricultural journals, and in some agricultural works of otherwise creditable authority. I must preface my narrative by relating how that falsehood took its rise, how it became popularized, and how it is refuted, and then proceed to the real history of this celebrated breed of cattle.

The popular *false* history of the origin of the improved race of short-horn cattle is simply this: In the latter part of the last century Charles Colling, a celebrated English breeder of short-horns, living in the valley of the river Tees, in the county of Durham, had a neighbor named O'Callahan, who owned a red polled or hornless Galloway heifer. O'Callahan bred this heifer to a short-horn bull belonging to Colling, called Bolingbroke. The produce of this heifer was a bull calf, half Galloway and half short-horn in blood. Colling became the owner of the calf, and when a yearling, put him to a thorough-bred short-horn cow, and she produced another bull calf three-fourths short-horn and one-fourth Galloway, which Colling called "Grandson of Bolingbroke." His "grandson," when a year old, past, he put to another of his thorough-bred cows, and she produced a *heifer* calf, which he called "Lady;" and that cow Lady, although she was seven-eighths short-horn blood, and only one-eighth Galloway, became, according to the story, the grand foundation, by the use of other pure short-horn bulls, of the improved English short-horns. That is the story which for the last thirty years has been disseminated all over England and throughout America, and which all who are not better informed believe to be the origin and title to a distinct or improved race of this celebrated breed of cattle. Now, let us see how this nonsense originated, and what it amounts to. About the year 1821 a Rev. Henry Berry, then living in Worcestershire, commenced breeding short-horns. He obtained the most of his herd from Mr. Jonas Whitaker, who was a short-horn breeder and a cotton manufacturer near Altry, in Yorkshire. It appears that about the time Berry commenced breeding, a controversy had sprung up in his neighborhood as to the relative merits of the Hereford cattle and the short-horns as profitable beef animals; and Berry, in the year 1824, wrote a pamphlet on the subject in which he professed to give a history, as far as it went, of the "Improved Short-horns." In this he gives Charles Colling the principal credit of improving the original breed, but says *nothing* of the "Galloway cross." The only other breeder whose name is mentioned is Mr. Whitaker, of whom he (Berry) purchased his own stock. In the year 1830 Berry republished his pamphlet without particular alteration of the text.

In the year 1834 the first substantial history of the various breeds of cattle in Britain, Scotland and Ireland was published under the auspices of "The Society for the Diffusion of Useful Knowledge," in London, and William Youatt,

a veterinary surgeon of note in Middlesex, was employed to edit the work. The book was painstaking, got up with commendable industry, elaborate in detail, and well written. It was a *compilation*, chiefly from competent authorities, and, so far as could be ascertained, truthful in the main. There was more or less "*job*" work in the compilation, no doubt, besides what Youatt himself contributed of his own knowledge, and with a strange and mistaken infatuation he *jobbed* out the history of the short-horns to Mr. Berry. Now Berry was a partisan solely. It was said that since he wrote his pamphlet above mentioned, he had differed with Mr. Whitaker, and had also got into his own herd—indeed, he confesses it—some of the bastard or "alloy" stock of Colling's Galloway cross. Being now employed to make up a history of the short-horns for Youatt's book, he discarded his pamphlet history so far as to omit Whitaker's name altogether and still retained Colling's, but for little further apparent purpose than to tell the story of his "Galloway cross," and make that the foundation of all excellence in the "improved" race of short-horns. He gives the portraits of his own stock of that cross, describes Colling's great cattle sale in the year 1860, and glorifies the "alloy" as selling for higher prices than any other, and draws all his conclusions to impress the public mind that such was the fact, muddling it up with just enough probability and truth to cover a downright falsehood. Such was Berry's history of the origin of the "improved short-horns."

Youatt knew no better than to let the story go. The book was published, and the History of British Cattle was adopted as authority for short-horns, as well as for other breeds described in it. And that Berry authority has been quoted so often and so long, that almost everybody who has any notion at all on the subject has taken it for granted that the Youatt-Berry history of this bastard origin of the short-horn race of cattle was a true one instead of a lie. The result of the whole pretended origin has been that the Galloway cross, by breeding the female descendants of it to pure short-horn bulls, was soon lost in the pure blood, and neither Colling nor any other good breeder ever attempted a repetition of it since, or of a direct cross with any other breed to improve the short-horns, so far as is known. The other short-horn breeders of the day had no faith in the experiment, and none of them took interest enough in the matter to publicly contradict Berry's pretended history, and so his falsified story has floated, and probably will float down the stream of time, until corrected opinions of the short-horn breeders shall discard it. The first volume of the American Short-horn Book, published in the year 1846, and the second volume, in 1855, placed the history in its true light; but as these volumes are of limited circulation, only among the breeders of pure short-horn blood, they meet only a small circle of popular examination. Thus ends this rambling preface, and we proceed to the *true* history of the short-horns.

So long as eight or nine centuries ago, before William of Normandy conquered England, the Danes and other Scandinavians of northern Europe held for a time the kingdom of Northumbria, in the north of England, comprising the counties of Northumberland, Durham, and York. The Danes also conquered the countries south of Denmark, on the continent—Jutland, Holstein, and a part of Holland. They were a commercial people, as well as warlike. Emigrants came over from Denmark into England, formed communities, and permanently remained there. They brought over cattle from Denmark, Jutland, and Holstein, and those cattle were short-horns probably, the material from which the present race are descended, but of rude and rough character, such as are still found in the countries where the progenitors of the present English race originated. They possessed, however, good feeding and great milking qualities, and were a valuable race. As one proof that such cattle existed in Durham at an early day, there was a cow sculptured, and is now to be seen, on one side of the tower of the cathedral of Durham, whose effigy shows the shape and general appearance of a short-horn. That tower was finished soon after the year 1300; and in the

county of Durham and the adjoining county of York on one side, and Northumberland on the other, the breed has been kept ever since, so far as history or tradition gives any account of them. It cannot be expected that in those days of war, brutality, and comparative barbarism, cattle would be anything but coarse and unrefined, for the agriculture generally was as rude as the people. But as agriculture improved with advancing civilization, their cattle kept pace with the progress of the people, and they were no doubt improved in quality and appearance, until they became what our representations show them to have been at the close of the last century.

It may be asked why, if these cattle were of such excellent quality, did they not find their way all over England during the long centuries since their first introduction to the three counties of York, Durham, and Northumberland? The answer is simply that there already existed different breeds in other quarters and counties of England, which the good people keeping them thought better than any others, and as intercourse through the different sections of the country was difficult, by reason of bad roads, no roads at all, and other obstacles, therefore the various breeds were *localized*, and seldom went out of their own territories, except to the great cattle markets, and then chiefly as fat beasts for slaughter.

We have accounts, as early as the year 1730, of several herds of fine short-horns existing in the three counties named. One of the estates of the Duke of Northumberland, at Stanwick, had upon it a select herd. Other estates of noblemen and gentry, in that county and in Durham and York, had them, and distinguished men and farmers bestowed much pains in improving their herds and preserving the purity of their blood. It has been asserted that the cattle were occasionally improved by the use of Dutch bulls imported from Holland, but no well-authenticated *proof* of the kind is known to exist. On the contrary, "an order in council," in the reign of Charles II, prohibited the importation of cattle from abroad, and that order was continued until late in the last century—too late for any such improvement as is asserted to have been made by Dutch bulls, which must have been imported as early as the year 1700 to 1725, and the order was in force from some time previous to 1680, more than one hundred years.

Besides, there is no certainty that the English short-horns could be thus improved by any foreign cross. They had assumed the white, red, red and white, and roan colors, if they had ever had any other, while the Dutch cattle were chiefly black and white, and coarser every way, in their shape and appearance. But this fact need not be further discussed. It is only a *tradition* or supposition, unsustained by proof, and denied by positive testimony and official record.

Coming down to about the year 1780, we find two brothers, Robert and Charles Colling, established as farmers and short-horn cattle breeders, at Bampton and Kelten, near the river Tees. Their father had been a breeder of short-horns before them, and, in all probability, they well understood the breed and the best modes of its management. Good cattle of pure blood abounded in the neighborhood for a wide territory around, and these young men, with much judgment and address, purchased the best blood they could obtain, and commenced their career. They had many fine cattle, and let out their bulls for breeding purposes, at high prices, which yielded them large gains. Yet other and older breeders around them were not idle; they had equally as good cattle as the Collings; but the latter, particularly Charles, was a man of much address, and became more conspicuous outside of his own vicinity as a breeder than, perhaps, any of his contemporaries. Convinced of the superior value of the short-horns as a farm stock, in the year 1796 he selected a fine thorough-bred steer, and fed him up to six years old for exhibition. He sold him at that age, and he was transported in a huge wagon, fitted up for the purpose, through nearly all the counties of England, and some portions of Scotland, as a show. He was called the "Durham ox." At six years old his weight was 3,024 pounds: at eleven years old he had dislocated a hip, and after two months' suf-

fering, in which he had lost much flesh, was slaughtered. His dead profitable weight of meat, hide, and tallow was 2,620 pounds. Soon after the Durham ox was sent on his travels, Robert Colling fed a beautiful white thorough-bred heifer, and sent her out for a show through many counties. She was called the "White heifer that travelled." Her weight was enormous, estimated at 2,300 pounds, and her dead profitable weight at 1,820 pounds. Accurate portraits of these cattle are to be found in the fifth and sixth volumes of the "American Short-horn Book," for the years 1861 and 1863.

The exhibition of these cattle, with their marvellous weight and symmetry of form, aroused public attention to their merits in various counties of England, and from that time they became the object of wider observation and demand than had existed in the localities where they had long been kept. Sales became frequent, and at high prices. Strict attention was paid to the purity of their blood, and correct pedigrees were kept of their lineage and breeding. Charles Colling sold out his herd in the year 1810, at high prices—one of his bulls selling for the enormous sum of 1,000 guineas, ($5,000,) and others ranging from 150 to 300 guineas. The prices of all agricultural products were much inflated at that period, and at no subsequent time have they been so high; yet it was no uncommon occurrence for the *best* short-horns to sell for 150 to 300 guineas, and even higher, from that day to the present, in England. Other breeders may be named cotemporary with the Collings, as Messrs. Maynard, Wetherell, Waistell, Mason, the Booths, Bates, Wright, Chenye, Trotter, and others, perhaps equally good breeders, and into whose hands many of the best short-horns of the present day trace their pedigree.

From the counties where the short-horns had been so long bred they began to spread into other parts of England. Their value for crossing upon and improving the common cattle, and some breeds of the district even. was ascertained, but people so fixed in hereditary notions as English farmers were slow to throw aside long-settled usages and opinions for the adoption of new and untried ways, whether relating to farm stock or products. Still, trials in the use of short-horns brought conviction of their superiority over the old breed, and they gradually spread over the land and increased in numbers down to the present day, until there is scarcely a county where good soil and a high order of agriculture prevails, in England, Scotland, and Ireland, that cannot boast its herds of well-bred cattle of that breed.

AMERICAN SHORT-HORNS.

A like increase has obtained in the United States. From the year 1817 up to 1865, a period of almost fifty years, from the best accounts I have been able to obtain, there have been upwards of 600 well-bred short-horn cattle, bulls and cows, imported into this country, besides more than 100 into the Canadas. These cattle, and their descendants, have generally been bred with care and an eye to retaining not only their original condition, but, if possible, to still further improve them. It is hardly possible to conjecture the number of well-bred short-horns which have been raised in the United States since their first introduction, as down to the year 1845 no American herd-book record was kept. Since that year, seven volumes of American herd-books have been published, and an eighth volume, for the year 1867, is to be issued; and although, down to 1855, but a few hundred animals were publicly registered, in the year 1866 more than 6,400 bulls, and upwards of 10,000 cows, of well-authenticated short-horn blood, were recorded in the seven volumes, the last of which contained over 3,500 pedigrees. It is not too much to assume that there are now within the limits of the United States quite 6,000 well-bred breeding animals of that race, two-thirds, or 4,000, of which are females.

From the instability and consequent fluctuations of American enterprise, in things not established in successful results beyond the shadow of a doubt, the

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progress of short-horn cattle breeding has had its vicissitudes. For many years they fluctuated in value and popular estimation, so much so as, at times, to be held at little above the value of our best native or common stock; but since the new impulse of 1853–'54 and a few succeeding years, they have largely increased, both in demand and price, and their value, as the basis of improvement for our native stock, is now established with a strength and potency likely to be maintained.

THEIR ADAPTATION TO OUR CLIMATE AND SOILS.

It was for many years supposed, in popular estimation, that short-horns were only adapted to mild temperatures and rich lands; that our richest pasture grasses only could keep them in summer, and corn in the shock, or the best of hay and grain, carry them successfully through the winter. That notion has been found altogether a mistake. Any climate in which common cattle can be well protected from the wintry elements, and any soil rich enough to yield abundant pasturage and good winter forage, has been found equally good for them as for others. *Enough* food, and that of good quality, with good winter protection, *any* creature of the bovine race must have in order to thrive; and the short-horn needs nothing more. From the severe latitude of northern New England, west to Minnesota, away down to the Carolinas, and far west to the Mississippi, to California, and to Oregon, they have found their homes, and succeeded in an abundant increase and a healthful growth. A sufficiency of herbage is all they need, and with that the question of their success in any portion of the United States is solved. East of the Rocky mountains, between the latitudes of 35° and 45° north, and below 35°, *according as the country furnishes the proper forage for them*, they will equally thrive; while west of the Rocky mountains, where the climate is tempered by the breezes of the Pacific ocean, from Lower California, north to Puget sound, their success is sure.

Their endurance under long journeys has also been proved. In a letter now before me, received only a few days since, and dated at Willamette, Oregon, Mr. Josselyn T. Foulkes writes: "My short-horn cattle stood the trip across the plains remarkably well, the heifers particularly. It convinced quite a number of our breeders that thorough-bred short-horns can endure as much hardship as the common stock. We travelled from twenty to thirty miles a day, and often the cattle were in advance of our mule and horse teams. Many persons endeavored to persuade me to sell them at Omaha, asserting that they would never reach Oregon—that they were too delicate." These were a small herd purchased near the Mississippi in Iowa, and taken to Oregon for the foundation of a permanent stock in that rich grazing region. Other short-horns have been driven across the plains to California, within the last five years, with equal success, where they are now thriving.

Thus they have become established in America, as in England, as a race eminently fitted for our soils and climates; but I insist on the condition that they have abundant forage on which to subsist, and of which they require no more, according to *weight and bulk*, than the native stock, and in my own opinion, from long experience, not so much, by reason of their compact frames and lighter proportion of offal in the carcase. But of that more hereafter.

NOT TO BE RECOMMENDED EVERYWHERE.

While commending the short-horns for our severe climate, and to all localities where *good* pasturage abounds, with sufficient winter fodder, there *are* places to which I would never take them, localities of wide breadth, where it is difficult for even our native stock to thrive. There are mountain ranges which, although producing sweet and nutritious herbage, are so difficult of access, by reason of

their broken surfaces, that only the lightest and nimblest cattle can graze them, and they literally have to *toil* for a living. In such localities a lighter, nimbler breed may thrive, while the heavier and more sluggish short-horn would decline. Yet such places are comparatively few, and their existence detracts nothing from the *principles* of my argument—the value of the short-horns to improve our native stock, in general, and to which I now address myself.

HOW OUR NATIVE CATTLE ARE TO BE IMPROVED.

We have seen that, in our beef-producing States and Territories, there are nearly four and a half million of milch cows. I will throw out the half million and upwards in Texas and New Mexico, as being in too wild and unreclaimed a condition, through their uncontrolled habits and modes of keeping, for careful breeding; and will also throw out one million from which no calves are raised, the cows being devoted to supplying milk for the consumption of towns, villages, cities, &c. Here, then, are three million of cows, on an average capable of producing, and which, probably, do produce, two and a half million of calves, annually, for rearing. Throwing off the odd half million of females which are bred into milch cows for family use, there will be left two million to be bred for beef purposes alone. Some of these steers are used as working oxen; but as the ultimate destination of the great majority of them is the shambles, the importance of making the best of their capacity for beef production is apparent.

Now, if two million of cattle, at the ages of three and four years, can each be made to yield, by the use of good short-horn bulls, more beef than native stock, at the same age, with no greater consumption of food, (which I contend is the fact, and shall presently prove,) an aggregate of 400,000,000 pounds of profitable meat is *added* to the annual production of the country; and that 400,000,000 pounds of beef, at the moderate price of six cents a pound, amounts to $24,000,000, while every calf slaughtered for veal, at six weeks old, would bring, by weight, one to two dollars more than a common one.

This, to an uncalculating mind, may appear utterly visionary, but it may be easily demonstrated. We are to suppose that the present loose habits of cattle-breeding, long indulged in by a majority of our farmers, are to be measurably reformed; and, that, instead of castrating all their *best* bull-calves, and letting the meanest scrub among them run miscellaneously among the herd, as is now too often the practice, good thorough-bred short-horn bulls are to be kept as sires. Almost every calf begotten by such a bull, however inferior the cow, is capable of producing an average increase of flesh, at the ages named, equal to the estimate of 200 pounds. Three million of cows, allowing a bull to every one hundred cows, will require 30,000 bulls for their use.

I have supposed that, in the 6,000 thorough-bred short-horns now in the country, there are 4,000 cows. This would leave 2,000 bulls now fit for service, only one-fifteenth of the number required; the supply, therefore, is short of the proposed demand. It will take several years, however, to educate opinion up to the above standard of calculation; and it is possible that the efforts of our short-horn breeders, stimulated by an active demand, may meet the necessity as it grows. I might go into a calculation of the probable increase of bulls; but as it is a matter of uncertainty, it is useless to estimate. It is obvious, however, that the increase would be more rapid under an active demand.

Another staggering question coming up to the breeder of "common cattle" is the *cost* of the bull, say, at two years old. He ought not to be used before that age, and the price for one good enough for grade breeding may be put at $300. It will cost, on an average, not more than $100 a year to keep him in a country of cheap forage. Every calf he gets will be worth, at three years old, (beef at six cents a pound, and two hundred pounds additional,) $12 more than the common steer, and, in point of fact, they often sell for $15 to $20 more.

Thus, in getting 100 calves, the bull actually earns $1,000 a year gross, and, deducting his keep, $900 net. Allowing for accidents, and calling the net profits $500, he more than pays for himself the first year, and his subsequent service will be clear profit. I have named $300 as the price of a bull two years old. This is a low price for a first-class animal, as many bull calves sell for twice, and thrice, the sum. Such high-priced bulls are wanted for thorough-breeding only, and should be kept solely for that purpose. Yet a bull actually worth $500 is frequently more profitable, for grade steer or heifer breeding, than a less valuable one at a lower price.

Another direct advantage in the use of short-horn bulls with common cows is the improvement of the quality of milch cows, and the prospective dams of a still higher grade of stock between the short-horns and natives. The first cross is only half-bred, the next is three-fourths, and so on, up to almost the full short-horn blood. If the latter blood be valuable, of course the more of it that is infused into the native the better.

As milkers, where the milking quality has been preserved in the short-horns, they are good. I am aware that public opinion, more particularly in the western States, has classed many of them as indifferent, or actually inferior to good common cows at the pail. Such fact, if existing, is accidental. The short-horns are *naturally* good and large milkers; and where they are bred and reared for that object, no cows excel them. It has been only by neglect that the milking quality of the short-horn cow has declined, and this has resulted from the undue stimulation of the *feeding* quality, as both milk and flesh in excess cannot be made by a cow at the same time. A fine, handsome cow does not show well when in lean milking condition. Giving little or no milk, she fleshes up, shows grandly, and sells well. It is for selling and showing purposes, chiefly, that the milk has been neglected; but it can readily be restored by selecting cows and bulls which indicate the milking tendency, and breeding and rearing the young for that object.

HOW BULLS SHOULD BE KEPT FOR BREEDING PURPOSES.

In this department circumstances must be consulted. In the majority of our stock-growing districts, cattle are confined in pastures. In other sparsely settled districts of country, in the wide prairies of the west, they run at large, promiscuously mingling in herds belonging to many owners, bulls and cows running together and breeding as chance or accident may control. In the latter condition, no rule or regularity can be expected in the quality of the young stock produced. It is necessary, if a better class of bulls is to be used, in these rambling herds of cows, that no bulls should run among them; and to control such result, local laws or agreements regulating them should exist among the owners of the herds. Those owning pastures have the matter under their own control. It is necessary that breeding bulls, when improvement in the young stock is intended, be kept confined in a stable or yard, or small grass enclosures, well fenced. While a calf, he should be broken to the halter, and when a year old, a ring should be inserted in his nose by which he can be controlled. Thus he is always manageable. When the cow is in heat, she should be brought to him. One service of the bull is sufficient, and more than two should never be permitted, as it exhausts the vigor of the bull, with no possible advantage. For the best effect, the cow should then be turned into an enclosure, by herself, until her heat has passed, which will be in a few hours, as turning her with the rest of the herd will permit them to annoy and worry her, sometimes to her disadvantage. This painstaking may appear troublesome to persons not accustomed to it; but no great good can be accomplished without some effort, and this small amount of labor is a trifle, compared with the benefit to be derived from it.

The bull, in his working season, should be kept in good condition, not abso-

lutely fat, but strong, sinewy, and in good flesh, by solid, nutritious food. He should also, if confined in a stable, have exercise, by walking some rods every day. During the fall and winter seasons, when not in use, his flesh may be somewhat reduced by lower feed, but not to become *poor*. He will be the better for this course the next season, care being taken to renew his flesh by increased and better feeding as spring approaches. By such usage he is kept healthy and vigorous, and may last as a good stock-getter till ten or twelve years of age. The opinion common with many, that a bull is worthless after he is five or six years old, is altogether a mistake. If *properly used*, his calves will be as good when the bull is at ten years of age as at four. It is only by forced growth, and excessive use when young, that his vitality is weakened or abridged, and more bulls are sacrificed by such treatment than by any other.

Breeders who have few cows may join in the purchase of a bull, and divide his services among their herds. This is as easily arranged as any other associated enterprise, and the result must be profitable.

THE IMPORTANCE OF USING THOROUGH-BRED BULLS.

Men who have bestowed little thought on the subject are not entirely convinced of the advantage of using thorough-bred bulls only, in advancing the quality of their stock, and a little explanation is necessary to enlighten them. In all thorough-bred animals, of whatever kind, the good qualities are *concentrated*. That is to say, *they breed alike*, throughout, from sire to son, mother to daughter, and so on, down to indefinite generations. There is an unmistakable likeness prevailing among them. We have seen that our native cattle are made up of incongruities, in size, shape, color, and quality. There is no uniformity of likeness among them. Some are good, more of them indifferent, both in appearance and quality. Some of the young resemble the sire, others the dam, and a great many neither, but take the appearance and qualities of ancestral relatives generations back. They have no fixed or permanent character, but are an aggregation of various qualities and blood, possessing (owing to their miscellaneous mode of descent) no particular characteristics which can be depended upon. It is this uncertainty which detracts from their value. Use a thorough-bred bull to these miscellaneously-bred cows, however, and his blood is so strongly infused into their offspring, by his own *fixed* characteristics, that his stock at once partakes largely of his own quality and appearance. Now, let the *full* blood of this bull be repeated on the half-blood heifers, and his blood becomes still stronger in them, and their stock more nearly resembles his blood (there being two crosses of it in them) than that of their dam, who has one-half the inferior or native blood; and so on to any number of these full-bred crosses, until the appearance of the progeny resembles the thorough-blood almost beyond a distinction to the inexperienced eye. On the other hand, among the cross-breds' progeny of the first generation, or half-breds', some very choice ones will be found partaking largely of the qualities of the sire.

The unpracticed breeder may think that, with so promising a calf, a bull may be raised that will answer his purpose, and the quality of his young stock, from common cows, (from which the bull sprung,) will be good enough, and, therefore, he uses him for breeding accordingly, and finds his progeny every way inferior, and wonders why it is so. The reason is plain: this half-bred bull had, in himself, one-half of the inferior or native blood, which was just as strong in him, and as likely to transmit its inferior quality through inferior dams, as his own share of the good blood which he had drawn from his sire, and thus there is little progress made in improvement from this mongrel bull. Still he is better than a "native" bull, and should be used when a better one cannot be had. The same result will occur from breeding these grade animals among themselves. The inferior blood is quite as apt to strike out among them as the superior, and

of course an incongruity appears in their various characteristics, and all higher improvement ceases. Hence there is no certainty of *continuous* improvement otherwise than by the use of thorough-bred bulls.

HOW STOCK SHOULD BE BRED AND REARED.

Long practice in different sections of our country has substantially settled this matter, according to climate and to the kind of forage used. The farmers of the northern and middle States mostly use barns, stables, and sheds for the winter protection of their neat stock. West of the Alleghanies, and south of latitude 41° north, and even above that, less shelter is used, and over wide districts of country scarce any winter shelter at all, the cattle running out the year round, exposed to all vicissitudes of the weather. They are drenched with rains, frozen with sleet, and pinched with cold. These extreme changes are prejudicial to their highest thrift and uniform condition of health and growth. Still, with plenty of food, cattle do thrive under such usage, but with a large additional *winter* consumption of forage. This practice is not likely soon to be changed. Some people think it is the best and cheapest way to raise cattle, all things considered. They have tried no other way, and do not *experimentally* know the difference between the economy of out-door herding and sheltering their stock, and the wastefulness of their own careless ways. As their means increase, and a necessity arises for the better husbanding of their farm products, they will build shelters and realize their advantages. Well housed or sheltered cattle will winter on one-third less food than if exposed to the elements. It takes one-third of their food when out of doors to keep up the internal heat of their bodies.

Farmers who give no artificial shelter to their stock contend that trees, stacks, fences, or any accidental barriers against winds and driving storms, are sufficient protection. This is not so, however. Rain and snow fall through trees, and, although they may to some extent ward off high winds, they are no protection from intense cold; and in the sweeping blasts that prevail on the wide prairies of the west, nothing can supply the shelter afforded by buildings. The extra winter forage expended on unsheltered stock would, in five years, pay for all the buildings to give them perfect winter protection; and barns and sheds are commended to every stock grower who can find the means to provide them.

The best season of the year for calves to be dropped is just after the first early growth of grass in the spring. The weather is then genial; the grass supplies abundance of milk to the cow; the calf grows well, soon takes to cropping the tender and nutritious grass, and thrives apace. There are two ways of rearing the calf: naturally, by drawing the cow's milk; artificially, by feeding the drawn milk from the pail. Where milk is of little value it is less labor to let the cow nurse the calf. For ordinary stock purposes, one cow will bring up two calves well to four months old, when they are fit to wean. Calves should never be suffered to run loose with the cows; they should be confined in small pastures to graze, and only let to the cows at morning and night, at intervals of as near twelve hours as may be. Thus the calf has its meals regularly, and the cow is as regularly relieved of her milk without pain or over distention of the udder. If the cow nurses her one calf only, half the milk may be taken away by the milker, generally by milking two teats clean, and giving the calf the other two, the milker being careful at the time that the udder is drawn clean of all its milk.

I will be a little more particular in the matter of this self-nursing of calves. The first thing to be done with a calf at birth, and after the cow has licked it dry, is to let it draw all the milk it can from the udder, the attendant then drawing the udder dry by hand; then tie the calf up by a rope in a secure place, thus putting it under command. It may be let to the cow twice or thrice within the next twelve hours, in order to let the new milk work off, medicinally, the intestinal matter deposited before its birth. This is indispensably necessary to its

welfare. After a few days' confinement with a rope the calf may be turned loose in a stable, shed, or small yard. It is done with trouble, I admit, but the labor is well expended, for the calf will not forget its first discipline in confinement. The cow should never be neglected in her milk, even when it is intended for the calf to take all, if needed, as, if the cow gives more milk than is wanted, a teat or two may be neglected, and ultimately lost for future yield, besides creating inflammation and giving her great pain. I have seen many cows in native herds which gave milk from one, two, or three teats only, by reason of this bad usage. Another difficulty in permitting the calf to run loose with the cow is, that as they nurse nearly every hour of the day, the udder is not distended to its proper size, and thus becomes habitually contracted; and after nursing, never gives so much milk as if regularly distended twice a day, as it would be by only having her milk drawn twice in twenty-four hours instead of every hour or two.

Calves should have as good pasture after weaning as before, that they may go into winter quarters stout and in good condition. They will then go through the winter well on hay alone, if of good quality, or nice, well cured corn-stalks. Straw is poor stuff for wintering calves on and will not carry them through safely without meal or oats, and hay or good corn-stalks are better without the meal or oats than the straw is with them. After the first winter, with plenty of pasture and common winter fodder, and salt once a week, the young stock thrive apace, and no further *extra* care of them will be required.

When heifers are intended for breeding beef stock only, they should take the bull in the month of June or July, after two years old, so as to bring their first calf at three years. They then have a good growth, and with ordinary keep will breed regularly afterwards. For dairy or family purposes, heifers may come in earlier, as they usually make better milkers than when permitted to bring their first calves at three years; but at such early age they require extra care and food, which the farmer does not always choose to give them.

Calves may be easily raised by the hand when the milk is wanted for family or dairy use. For the first two weeks, they should be fed on new milk. After that half the quantity of their food may be skimmed *sweet* milk; or cheese whey, mixed with new milk, will answer. At the end of a month cooked porridge of water and Indian, barley or oatmeal, mixed with skimmed milk or whey, will serve, being sure that enough is given to keep the calf growing well. If, however, calves be dropped late in the fall or winter, they should have access, after the first month, to fine sweet hay or corn blades, which they will eat readily and profitably.

PREPARING STOCK FOR FATTENING.

Thrifty grade short-horns, the winter after two years old, should be fed with all the hay or corn fodder they will eat, if not wintered on blue grass pastures specially reserved for their use, as is the practice in some portions of our grazing States. In addition to this forage, they should have a moderate allowance of corn or corn meal, as circumstances will admit. This course pushes on their growth, and they go out into their spring pastures at three years old in fine condition. Thenceforth, with abundant summer pasturage, they will rapidly improve. Many three-year-old steers thus fed will go to market as beef cattle in the coming fall, or, if retained for winter feeding, will be ready with abundant food to be off at any time before the next grass season. And here lies the great advantage of the short-horn blood in their early preparation for the shambles. The common or native cattle require full five years to obtain sufficient growth to fat with any profit. If fed with grain at three years old, the food goes to the growth of bone and sinew and common muscle, and not to good flesh and tallow. They have a deal of offal to carry in the way of head, horn, dewlap, and general coarseness, which the better bred animal has not. Thus the native beast consumes his extra food to no profit, while the short-horn converts

his food into profitable flesh and tallow. In this way it is seen that a great loss of time is suffered with the native stock, one or two years, at least, and sometimes more, besides the expense of keep during that time, interest on the capital invested and risk of death or disease; while the short-horn turns all his food to good account, and is marketable at an age never exceeding four years, and always profitable to his breeder, grazier or feeder.

A COMPARISON OF PROFITS.

It has been shown that the short-horn, from half-bred and upwards, has attained a growth and ripeness for market one or two years in advance of the native stock and at a greater weight; that is to say, the short-horn has reached as great a weight at three years of age as the native has at four or five. The short-horn has eaten no more food on the average than the other. For example, take twenty steers in the fall of the year in the pastures of the grazier—one-half of these good grade short-horns, half blood and upwards; the other half common stock, taken as they run. They have been fed alike; had an equal chance. The grazier wants to sell his stock, and a feeder comes along desiring to purchase for winter fattening. Say good cattle are worth five or six cents a pound, live weight, in the pasture; the short-horns are in good condition, and the natives only in good *store* order. It is no stretch of truth to say that the short-horns are 200 pounds heavier, live weight, than the others, and the feeder, of course, selects them, because they are fit for his purpose and the others are not; he does not want the common ones at any price. Consequently the latter are in the grazier's hands for another winter and summer at additional expense for a full year's keeping. Then possibly a part of them may be sold to the feeder, and the remainder left on his hands for still another year's expense of food and capital invested, and then sell for a cent or two less per pound than his short-horns brought him, when possibly they have approached the weight of his short-horns sold a year or two before. This is no fiction, but the history of a thousand instances which could be detailed by graziers and feeders.

To illustrate the capacity of a well-bred short-horn for taking on flesh, I give the portrait of a steer, with his weight and dimensions. I do not expect that all short-horns are to be fed up to this pattern, but the specimen shows what may be done.

Now, how is it with the feeder? He took his short-horns home, fed them and took them to market. They arrive at New York or any other large seacoast market as "Kentucky or Ohio Durhams," although they may never have seen Kentucky or Ohio, nor been within a hundred miles of those States. They are driven into the cattle yards on a market day, where they meet any numbers of cattle of all sizes, breeds and qualities. The butchers come round to select beef for their market stalls. I will suppose the market has an average supply of beeves and the price steady. There are all sorts of buyers. Some want "the best," and will have no others. Some want "middling" cattle; others deal only in the poorest and lowest-priced stock, each having their own particular trade and grade of customers. Prices vary, I will say, from six to ten cents a pound, live weight. The fine, well-bred, well-fed short-horns or Durhams command the highest price at a quick sale, while the others are chaffered over at a lower price, according to quantity or condition, and wait, perhaps, over for another week's market, at a considerable expense and loss of flesh, the owner of the good stock having pocketed his money and returned home. Such is the history of our cattle markets every week in the year.

In all this experience of cattle life, with the exception of the use of the short-horn bull in begetting his calves, the breeder of the better cattle has been at no more expense than the breeder of common stock. The grazier has been at no more expense in rearing the good ones, nor the feeder in fattening them, than

must be incurred for the natives; and the drover has paid less average freight per pound on them to market than upon the lean-fleshed and rough-boned beasts which carry twice the amount of offal to good consumable flesh on their carcasses. As one goes into the great cattle markets and sees the amount of inferior cattle which comes in under the name of "beef cattle," he wonders where it all comes from, or what could induce men to send such stock to market. There can be no possible profit in them from birth to slaughter—a loss, in fact, to every one who touches them, to rear, graze or fatten, if by any possibility they can be made fat. Old cows and broken-down working oxen, on which corn would be well nigh wasted if fed in any great quantity, must go to market and sell for the most they will bring; but why healthy young cattle, not over four or five years old, full half the weight of which are heads, horns and bones, are reared, grazed and fed, and then sold for half or two-thirds the price of really good cattle, such as almost any farmer may breed with little more expense and trouble, (not half so much of either as the difference in price,) surpasses comprehension. A man who occupies land worth not more than ten dollars an acre, and can let his cattle range over land that he does not own, may have an apology for keeping and rearing mean stock; but when men occupying farms worth thirty to one hundred dollars an acre, and frequently more, with abundant means and opportunity to deal in good stock, can content themselves with breeding and rearing inferior animals, I fail to discover any apology beyond sheer ignorance or stupidity.

MILCH COWS.

Another source of profit from the use of short-horn bulls, well worthy of consideration, but which has been only incidentally named, is the breeding of grade cows for dairy purposes. The dairy interest in some of the middle and eastern States has, of late years, grown into great importance. Immense quantities of butter and cheese are now manufactured for export as well as for our own domestic markets. Wide districts of country in some of our States, where it is unprofitable to grow grains or even to pursue "mixed farming," are now devoted to the dairy alone. These districts are composed of hilly, moist, well-watered lands, abounding in sweet grasses, the best for producing cheese and butter. The farmers occupying these lands devote their whole attention to these products, not even raising their own bread or meat. The demand for good cows has become so great among these dairymen that within the last five years prices have risen from twenty-five to sixty, and even a hundred dollars, each, for prime animals. It is as easy to raise a good cow as a poor one, though not quite so *certain*, and with the proper material at hand the business is a sure and a good one, for if the heifer at three years old does not turn into a good milker, she can surely be fattened off, after her first calf, and made into good beef.

Let us understand this process. There are to be found all over the stock-growing regions cows of the common or native kind, which are excellent milkers. Let the person proposing to go into *cow*-breeding select the required number of good milkers for producing a given number of calves each year. Then let him select a compact, fine-boned, well-bred short-horn bull, well descended from good milking stock, which will not be difficult, as it has been shown that the short-horns are naturally good milkers. These cows, if bred to a common bull with all sorts of indifferent blood in him, would in all probability produce a mixed race of mongrels like themselves and their ancestry, some good milkers and others poor. Put to a well-bred bull, however, inheriting qualities from a long line of good milking ancestors, they would produce good milkers, while the bull calves, made steers, would be equally valuable as the calves of any other well-bred bulls for rearing into beef cattle, the feeding quality being just as good in the steers of heavy milking cows as in others.

Heifer calves intended for milch cows should be brought up by hand if possi-

ble, early made gentle and easy to handle. They should be put to bull in June or July, after two years old, and will be marketable the next fall or winter before casting their calves, among the eastern dairymen. They may not bring so large a price then as they might if retained in the breeder's hands until their calves are brought forth and their milking qualities tested, but much labor and some risk is saved to the breeder by an early sale, and the dairyman has the advantage of bringing the young cows into his hand and making them all right for future use. The earlier or later disposition of the young cows is a matter of interest for the breeder himself to study.

THE PROPER SELECTION OF BULLS FOR BREEDING.

One of the most important points in our whole subject is the proper selection of a breeding bull, for either beef-producing or dairy purposes. I have spoken of some tribes of short-horns, in which the milking quality has been ignored, or little cared for, in the effort to promote the flesh-producing tendency. Such sacrifice of the milking quality has resulted in earlier maturity, greater symmetry of form, and a more imposing style of appearance generally of the individual animals, all the better, probably, for the production of beef alone, as almost any cow will give milk enough for the first few months after calving to raise her calf in good condition, and where the milk is no object, the cow may as well be so used as to continue her longer in milk. She thus retains her high condition, always shows well, and produces, coupled with a proper bull, a good calf; yet the cow which yields largely of milk possesses the same tendency to take on flesh, when dry of her milk, and her bull calves will get equally as good steers as those which come of cows giving little milk; but for *milk* cow-breeding, the bulls descended from milk cows must be selected, as previously remarked.

It will be seen, therefore, that for beef-breeding alone the bull may be selected as well from a milking as from a non-milking tribe. The quality of the bull only need be consulted, and that quality, or a combination of qualities, I shall now attempt to describe.

To illustrate the description which follows, I give the portrait of a bull, whose pedigree will be found in volume 7, American Herd Book, page 5526.

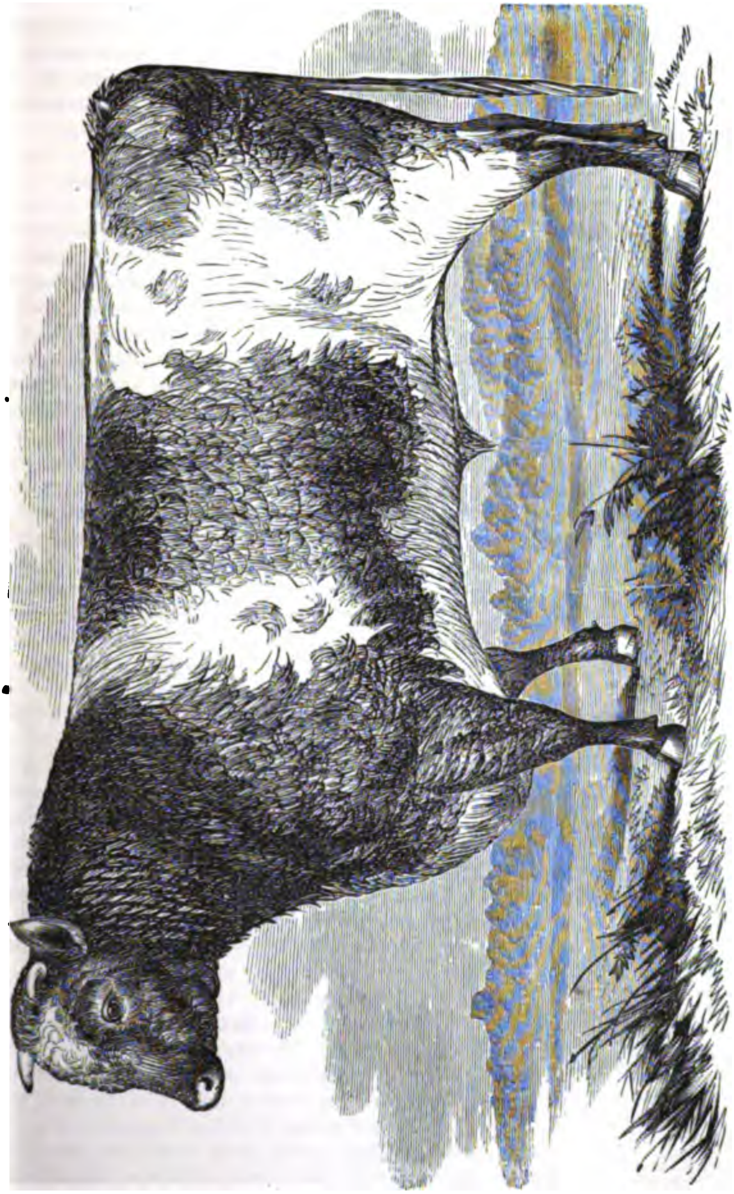
The bull's head should be fine in all its parts, yet masculine, and denoting in a high degree the superiority of his sex in strength and form; the muzzle small; the nostril wide and open; the nose cream color, orange, or drab, even a nut brown, but never smoky or black, the latter being an indication of inferior blood; the face and jaws should be lean of flesh; the forehead broad, and face *slightly* dishing or concave; the eyes *prominent*, bright, mild, and lively; the ears small, and lively in action; the horn well set, flattish in shape, and waxy, not white in color, with no black, except at the very tips, inclining outwards, and not *much* upwards.

The neck should be somewhat arching, as showing strength and masculine power, and setting back well on the shoulders, with a clean throat, and no dewlap, except a slight pendulous thread of skin at the brisket.

The shoulders should be set wide, straight, and open at the top, smooth at the points, with a bull-neck rein, ending below with a full, thick brisket, projecting well forward. The knees should stand wide, and below them a firm, compact leg, ending in a clean, well-shaped hoof. The chine and back should be on a level from the shoulders to the tail; the ribs round, springing roundly in an arch from the back, and running down to give full room for the heart and lungs to play in a broad, deep chest, and running back well towards the hips, so as not to leave the belly looking *paunchy*.

The hips should be wide, and on a level with the back; the flank full and low; the loin full long, level, and broad; the rumps level, and well shaped; the tail set symmetrically and level, small, and round in shape; the thighs

PLATE XVIII.



SHORT-HORN BULL. (See page 314.)

broad, but not "buttocky;" the twist (space between the thighs) full, and well let down; the gambrel joints straight, as in the horse, and the leg below fine and sinewy. The temper of the beast should be mild and gentle.

These points constitute a finely-shaped, vigorous, and almost perfect animal.

As to the color, tastes differ. Red, red and white, and the red roans are mostly preferred; but any color from red to clear white is a good *short-horns* color, if the animal be otherwise good. White is usually least preferred, simply, I think, as a matter of taste, for I have seen as good white cows and bulls as of any other color. In thorough-breds, that color is hardly so salable as the reds or roans; but for beef-breeding, it is of little consequence what the color may be so that the animal itself is good. There are two other points, which I consider indispensable in constituting a first-class bull. These are fineness of bone, and a soft, elastic touch. The first is readily known by the general smoothness of the carcass, indicating a good feeder; the other, by a fine wavy growth of hair, and an elastic feel to the skin and flesh beneath it, like that of an India-rubber ball. Fineness of bone and "good handling," as it is called, usually go together. A rough-boned, coarse animal, with hard handling, I would never select as a breeding bull. If *cows* possess these harder qualities, and are *otherwise* good, they may produce quite tolerable calves, when coupled with *fine* bulls, and thus the stock may be improved; but every coarse *bull* calf should be castrated, and never be retained as a breeder.

Our American short-horns have been much improved in their handling qualities within the last twenty years. Some of the early importations were coarser in style and harder to the touch than we now have them. Our American standard of quality has much improved in these particulars, and when it is considered that coarse bone and hard handling are accompanied with a coarser quality of flesh, fineness of bone and "good handling" should always govern the selection of a breeding bull.

BREEDING THOROUGH-BRED SHORT-HORNS.

Having devoted as much space as may be considered necessary to the discussion of the main parts of the subject, it will hardly be complete without some remark upon the production of the *material* indispensable to the accomplishment of the object I have intended to promote. I have said that the use of grade or cross-bred bulls to produce an improved race of beef cattle, only half accomplishes the work, for the reason that the inferior blood is as apt to reproduce itself as the good blood is to perpetuate its superiority, and therefore an entire uncertainty remains as to what the quality of this progeny may be. It is doubtless an improvement over the native stock on which it is bred, but *not* the improvement which we seek and should accomplish; therefore the production of the thorough-bred animal is to be studied as the foundation of all actual improvement.

It is no boast to assert that we now have in the United States as good short-horns as can be found in England. Our enterprising breeders have sought, without regard to price, the best herds of that country, and drawn from them the choice of their favorite and most approved strains of blood. A sufficient proof of the excellence of our cattle is the fact that several young bulls, the produce of these choice selections, have been taken from this country by prominent English breeders within a few years past, at prices almost equal to any previously paid by our own breeders. Thus we have the material in our hands for all the improvement which can be attained in this department of stock breeding. It cannot be expected that in a paper of this brief character I can go into a labored discussion of the *principles* of fine stock breeding. A few general rules and remarks must suffice.

In starting his herd the breeder should use *pure*-bred stock alone, and this

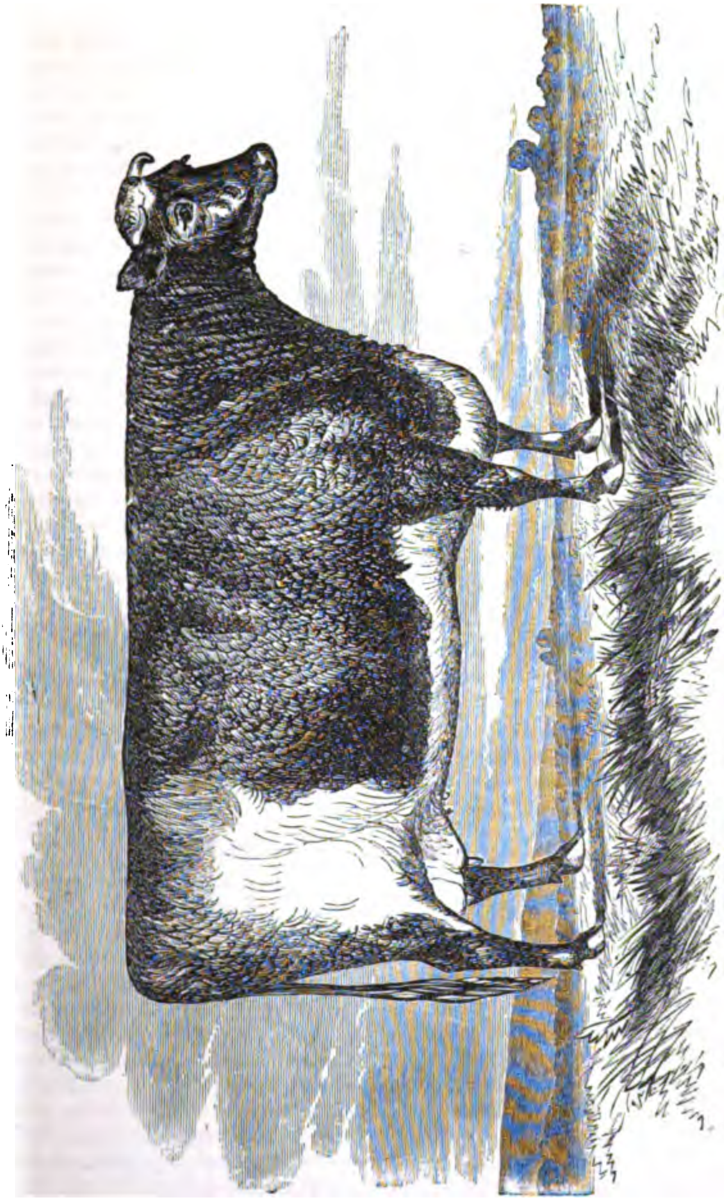
purity of blood is to be tested by the pedigree of the animal, as recorded in either the English or American herd-books. Every American herd of thorough-bred short-horns, with an occasional exception, may be found recorded in the American books, while the English herd-books contain the pedigrees of every herd of note in England, Wales, Scotland, and Ireland, together with some American and other foreign short-horns. Therefore every well-bred short-horn in this country should have a pedigree, which can be traced into one of these books; and as the pedigrees which have found place in the American books trace back into the English as their *original* record, the authority of the American registry is of equal value with the former. The purity of blood being established, the breeder has only to select the animal from which he intends to breed.

I have already named the chief points of excellence belonging to the race, as found in the bull. The same points apply to the cow, though modified to some extent by the gentler and more refined qualities of her sex. The opposite plate shows a good animal of her kind. If the milking quality in the cows of the proposed herd be no object to the breeder, he will select only for symmetry, good constitution, and general excellence of the individual animal. The bull should be chosen with equal care. If milk be an object, the points indicating that quality are to be considered, and selections made accordingly. The breeder of the refined stock must understand that the present high standard of style and blood has been reached by care and food, and every attention to preserve the naturally good qualities, and to attain still further improvement. So far as practicable a continuance of that care is essential. The chief requisites of good breeding, after selecting the proper animals, are good shelter in the inclement seasons, suitable and sufficient food, and close attention. They should not be over-fed, nor forced into growth, but their condition of flesh should always be good, and as near uniform as possible. Pasturage in summer, and good winter forage, are sufficient. Consanguinity or near relationship in blood between breeding animals is no objection, provided the animals be free from hereditary ailments or constitutional disease.

Theorists, taking their ideas from opinions concerning the admixture of nearly related blood in the human family, have objected to a like practice in the brute creation; but long experience and observation in breeding from the closest blood affinities in domestic animals, have proved the prejudice not only groundless, but shown the practice highly successful in combining the good qualities existing in such animals, and perpetuating them with greater certainty than by wide crosses with strange blood of different character, even in the same breed. Breeding from close blood relations in animals is called "breeding in and in." The most noted breeders and improvers of cattle in England have bred deeply in and in, and by that course the best of all their cattle have been produced. The system requires superior skill and judgment, however, and should not be practiced by the inexperienced. There are a few general and safe rules which, if followed by the breeder, will usually prove successful: First, never breed from a permanently diseased animal, as one afflicted with scrofula or any lung disease, or one troubled with chronic difficulties, as such infirmities may and are likely to be imparted to their offspring. Second, always breed from the best bull, the most perfect in quality and condition which your circumstances will command. Third, keep your stock in thrifty growth and good flesh, with suitable shelter from the extreme inclemencies of the weather. With these simple rules, strictly followed, there can be little doubt of success. Some general instructions relating to the management of breeding bulls, and the care of cows, will close the subject.

MANAGEMENT OF THE BULL.

The thorough-bred bull intended for breeding, when a day or two old, should be confined by a rope to a secure place. Give him a dry bed of straw to lie



SHORT-HORN COW. (See page 316.)

upon, and let him to his dam twice a day to nurse. At three or four weeks old a wisp of soft, sweet hay or well-grown grass should be tied within reach, where he can nibble it, as he soon learns to eat. At two months, if the season is favorable, he may be turned into a small enclosure where he can find plenty of grass and water, but tie him up during the night, after nursing. At six months he may be weaned from the cow altogether; or, if a supply of new milk be not at hand after the first two or three months, an abundant supply of skimmed milk, and corn, oat, or barley meal, may be added. At all events he must be well fed, and kept growing, and so continued until he arrives at two years. At a year old or less, if he become headstrong, place a ring in his nose, by which he may be led and rendered as manageable as a colt. If he be inclined to viciousness of any kind, his temper must be curbed by discipline. The safest way to lead him is by a short snap, with a chain link or two, attached to a tough stick an inch or more in diameter and five feet long. This will hold him at arm's length, and prevent his attacking his keeper.

At two years old he may be moderately used, say to fifty cows during the season. At three years old he may serve a hundred, and be none the worse for it if properly fed, but in such case an extra feed of eight to ten pounds of Indian, oat, or barley meal should be given him daily, according to his size, and the service demanded of him. Over-work and under-feed will impair his virility, limit his period of usefulness, and render his progeny infirm. If properly cared for he may last and do good service six, eight, or ten years; after six or eight years his work should be less than at three to six years old. Judgment must be exercised in this matter, as no positive directions can apply to individual cases. If the bull prove treacherous, or vicious, a blinder of leather or coarse canvas cloth should be fitted over his head to obstruct his sight, and prevent a direct plunge at his keeper. I have had one or two such in my own experience, and too much caution cannot be used in preventing these mischievous attacks. He should always be led to the cow, and seldom if ever permitted to run loose with her. He must never be turned loose with a herd of cows, as he will not feed, but be continually teasing them, will soon lose flesh, grow unruly, and be materially injured thereby. A bull should no more run loose among cows than a stallion among mares. Though not so fiery in spirit as the horse, the bull is equally inclined to indulge the propensities of his nature. Under proper confinement and subjection his stock will be better, and his usefulness greatly prolonged.

ECONOMY IN FATTENING CATTLE.

My remarks upon this subject may seem superfluous by those whose lives have been spent in the business of feeding cattle for market, particularly in the wide feeding districts of the West; but believing that the common mode of fattening stock must be radically changed, a few observations are ventured.

The usual mode of preparing beef cattle for market in the western States, after the grass season is over, is by feeding corn in the shock, and scattering it over a clean grass field, the cattle taking the corn in the ear, and consuming the blades and upper end of the stalks as fodder. The great merit claimed for this system is the saving of labor; as swine glean after the cattle, nothing is lost. In a country of dear labor like ours, this is an important item. Labor is costly, and the question for the feeder to settle is whether the loss by not grinding the corn into meal is not greater than the saving of labor; or, rather, will the saving of grain and fodder pay the increased expense of a mode of feeding requiring additional labor?

I can remember the time, before railroads penetrated the western States, when corn in the field was worth only six or eight cents a bushel, shelled measure, and two cents in the crib, or even when hauled by wagon to the nearest market town, if it could be said to have a market at all. Then, the economy of feeding

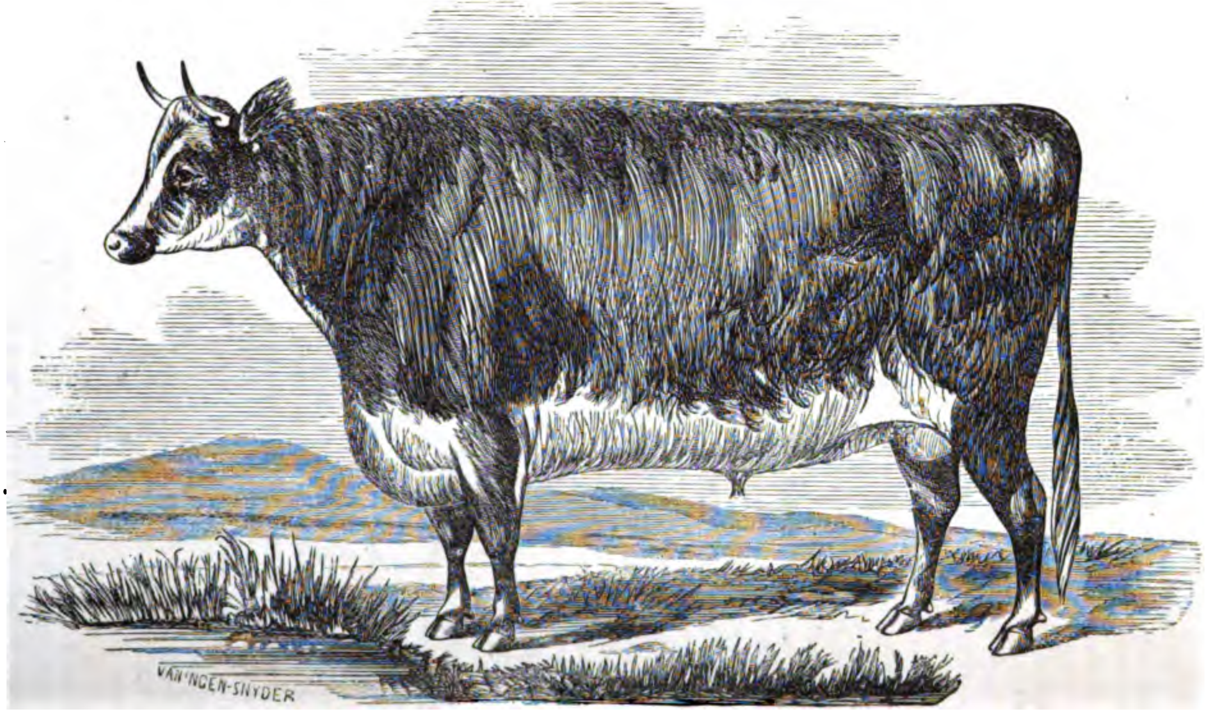
was no question at all. It was all-important for the farmer to get his corn into beef or pork at the earliest possible moment, so that he could drive his crop to market in those commodities. Cattle were turned into the corn-fields to feed on the standing grain, and having consumed all they could, the hogs followed them as gleaners. The cattle fatted, to be sure, and so did the hogs, after a fashion, but at a dreadful waste of grain. The only saving in the plan was that of manual labor in gathering the corn, and returning to the soil the manure now left on it, which latter, if the corn was consumed elsewhere, would have to be carted to the soil. But as this latter item was considered of little or no consequence, the loss was supposed to be comparatively nothing.

As the grain grew more valuable to the farmer at home, and railways penetrated nearer to him, he cut up and shocked his corn, and in the feeding season drew it to the feeding lot, and after the cattle had fed upon it the swine were turned in as scavengers. Such is the usual practice now in the western States, where corn has run from eight or ten up to an average of forty or fifty cents a bushel. It is needless to say that a great deal of this corn passes through the cattle unmasticated, hence undigested, doing them no good whatever. It may be said the hogs get it all; yet much which they are supposed to save by picking up goes through them but half cracked, and though by their own filthy manipulations some of it is again eaten, much waste must inevitably follow. Aside from this the frequent storms and severity of the weather prevent the cattle from gaining flesh as fast as they would if properly housed or sheltered; thus, much of the food, instead of making flesh direct, as in the latter treatment, is expended in creating heat to keep the animals warm. I will say that it amounts to one-fourth, at least; that is to say, three bushels of corn ground into fine meal, and fed in a manger, under a good dry roof, properly protected from the cold, with the top fodder belonging to it, make as much flesh in a given time as four bushels fed in the ear, in an outside lot, with no shelter.

Corn at forty or fifty cents a bushel makes no more beef than when worth only six or ten cents; therefore, all the extra flesh made by the corn now, costs three times as much, labor deducted, as formerly. But here interposes the question of labor, which is so costly. This is true to some extent, but not altogether. We now have the corn-shellers, which go by horse-power, shelling a hundred bushels a day; we have numerous mills that go by both water and steam; we have more capital, more facilities of every kind for relieving labor; and yet the farmer appears, in some of his operations, to be the very last one to take advantage of these facilities. True, we use the mowing and reaping and threshing machines instead of the scythe, the cradle, and the flail. We are obliged to use them. We could never gather and secure our crops without them. Why, then, not improve in the modes of feeding our beef cattle, as well as in other things? If three bushels of corn will make as much beef under this mode of feeding as four bushels will make under the old and common mode, why not adopt it? I believe an experiment will prove the fact that the difference in laying on flesh under a dry shelter will pay all the expense of properly husking, cribbing, taking to mill and back, and giving one-tenth for toll in grinding the corn; that feeding and taking care of the cattle in-doors is not more laborious than the out-door mode, to say nothing of the additional comfort and security of the cattle themselves.

In fattening animals of every kind, it is important to feed them at the season when they will take on flesh the most rapidly at the least expense. That season is in the late summer and autumn, when the weather is mild. I fully believe that the production of flesh, in proportion to the consumption of food, is one-fourth more in warm weather than in winter. Meal may be fed in the warm season, but corn can only be fed in late autumn or winter, as it does not ripen sufficiently until then, and it cannot be kept over in shock for another season. It may be said that fat cattle, for spring use, need not be fatted so early as to be

PLATE XX.



SHORT-HORN OX.

Bred by Thomas Bates, Halton Castle, Northumberland, England.

Slaughtered, 1808; age, six years; girth, 9 ft. 2½ in.; weight of two fore-quarters, 727 lbs.; hind-quarters, 682 lbs.; tallow, 206 lbs.; hide, 96 lbs.

ready for market by December. It will do no harm, however, and they will hold their flesh all winter, and on much less feed than if not so well fed in the earlier season, and they secure the large spring prices of winter feeding. This advantage can be fully obtained by feeding on ground grain in sheds and mangers, but cannot be secured by winter *shock* feeding.

The proclivity of our farmers for increasing the extent of their farms, and the consequent investment of all profits in the acquisition of more acres, instead of improving the lands they already possess and erecting suitable buildings for their stock, are the principal reasons why so many poor cattle go to market not *beef* at all, but in passable *store* condition only. To illustrate the manner in which some cattle men get through the world, I may relate that, some time since, a friend of mine, who owned three hundred acres on the Scioto bottoms, mostly in corn, went out on his annual cattle-buying tour. He found a hundred head or more in the hands of an old farmer, who owned a thousand or fifteen hundred acres of rich land, mostly in pasture and enclosed by high rail fences. Back from the road was a dilapidated log-house, with but two rooms in it, a little garden patch of perhaps a quarter of an acre, and fifty to a hundred acres in corn, or other crops; but not another building or shanty, of any kind, on the premises, except an old log-stable, for the accommodation of a few horses, with their gearing. Everything else was "out of doors." The swine grunted and rooted about the grounds, and the turkeys and chickens roosted in the trees. There lived the man and his family, a large one, composed of his "old woman" and a number of full-grown boys and girls, as unkempt, ragged, and ignorant as himself. He had bonds and mortgages and cash in the bank. My friend purchased the cattle and went into the house to pay for them; needing a light, the old man went to a shelf in the room, took down a tea-saucer filled with pig's grease, a button, tied up in a rag, lying in the middle of it, the furzy end of the rag sticking up by way of a wick, which he lighted at the fire. With the aid of this glimmer they sat down to the table, figured up the sale, and the money was duly counted out. After being carefully recounted by the host—for he knew as well as anybody what bank-notes were worth—he carefully "made his mark" at the foot of a receipt which my friend had written. That done, the latter got up, put on his hat, and, as he was leaving the room, the old man blew out his light before his visitor had reached the door. Such men do not raise short-horns, although they know good cattle when they see them, nor will they read this article.

This, I trust, is a rare instance. I have seen a few such, but they are fast disappearing. Our cattle-breeders, graziers, and feeders, as a class, are sagacious men, many of them possessed of great enterprise and liberality, from whose counsels I have learned much relating to their vocation. I have little doubt that, in the necessities of their business, and under the increasing facilities for stock transit to the seaboard markets, they will gradually and, I hope, speedily, adopt improved modes of preparing their beef cattle for consumption, as they have already introduced improved breeds into their herds, and with which they are rapidly progressing to great excellence.

The United States, in soil and climate considered, *is the best cattle country in the world!* We have only to improve our advantage, to be able to supply all of Europe with the salted meats required beyond their own limited supplies. But we need a more general diffusion of the better breeds, and more painstaking care, than we have been accustomed to bestow upon them, to secure the most profitable results. The right breed is with us, and the stock is to be obtained at fair prices. If we do not avail ourselves of the services of such animals, the fault and the loss is our own. Those who have brought them here, at great expense of time and capital, and have bred them with so much care, have proved themselves public benefactors.

CONCLUSION.

Having shown the value of the short-horns, as the great instruments by which American cattle-breeders are to permanently improve the beef-producing qualities of their stock, it must be understood that the use of short-horn bulls *alone* will not effect this object. The land must be good, the pastures abundant, and their winter forage of good quality and in sufficient quantity. To all these requisites must be added a due care of the stock, and a continuous watchfulness of their welfare in warding off disease, and promoting their best health. Men who are too lazy and shiftless, or careless, to attend properly to their stock, will never succeed in either growing good cattle, or making money out of them. A vigilant eye and a diligent hand are necessary to the accomplishment of the great results which, in this discussion, I have labored to promote.

AMERICAN SHORT-HORNS.

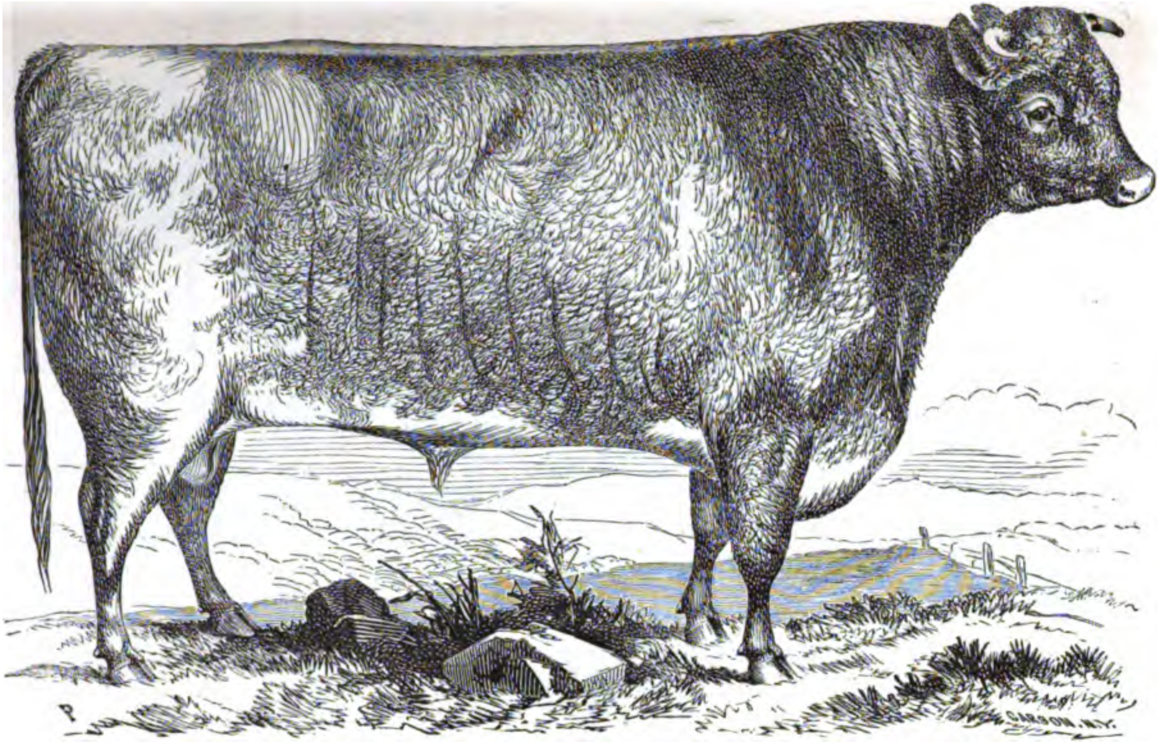
FORMER reports have been illustrated with engravings of some of the finest animals of the Samuel Thorne herd, upon which English breeders have drawn repeatedly for infusions of fresh and desirable blood. The accompanying subjects are selected from the herd of James O. Sheldon, of Geneva, New York, who has recently added to his own that of Mr. Thorne. The excellence, if not unqualified superiority, of the united herd, will therefore be acknowledged. The following are pedigrees of the animals represented:

"*3d Duke of Geneva*"—Roan; calved August 30, 1865; bred by James O. Sheldon. Got by Imperial Oxford, (4905;) dam Duchess of Geneva, by 2d Grand Duke, (12961;) g. d. Duchess 71st, by the Duke of Gloster, (11382;) gr. g. d. Duchess 66th, by 4th Duke of York, (10167;) gr. gr. g. d. Duchess 55th, by 4th Duke of Northumberland, (3649;) gr. gr. gr. g. d. Duchess 38th, by Norfolk, (2377;) gr. gr. gr. gr. g. d. Duchess 33d, by Belvedere, (1706;) gr. gr. gr. gr. gr. g. d. Duchess 19th, by 2d Hubback, (1423;) gr. gr. gr. gr. gr. gr. g. d. Duchess 12th, by the Earl, (646;) gr. gr. gr. gr. gr. gr. gr. g. d. Duchess 4th, by Ketton 2d, (710;) gr. gr. gr. gr. gr. gr. gr. gr. g. d. Duchess 1st, by Comet, (155;) gr. gr. gr. gr. gr. gr. gr. gr. gr. g. d. Duchess, by Favorite, (252) gr. gr. gr. gr. gr. gr. gr. gr. gr. gr. g. d. by Daisy Bull, (186;) ———, by Favorite, (252;) ———, by Hubback, (319;) ———, by J. Brown's Red Bull, (97.)

Gem of Oxford—Calved March 5, 1859; got by 2d Grand Duke, (12961;) dam Oxford, by Romeo, (13619;) dam Oxford 5th, by Duke of Northumberland, (1940;) dam Oxford 2d, by Short Tail, (2621;) dam Matchem Cow, by Matchem, (2281;) dam ———, by Young Wynyard, (2859.)

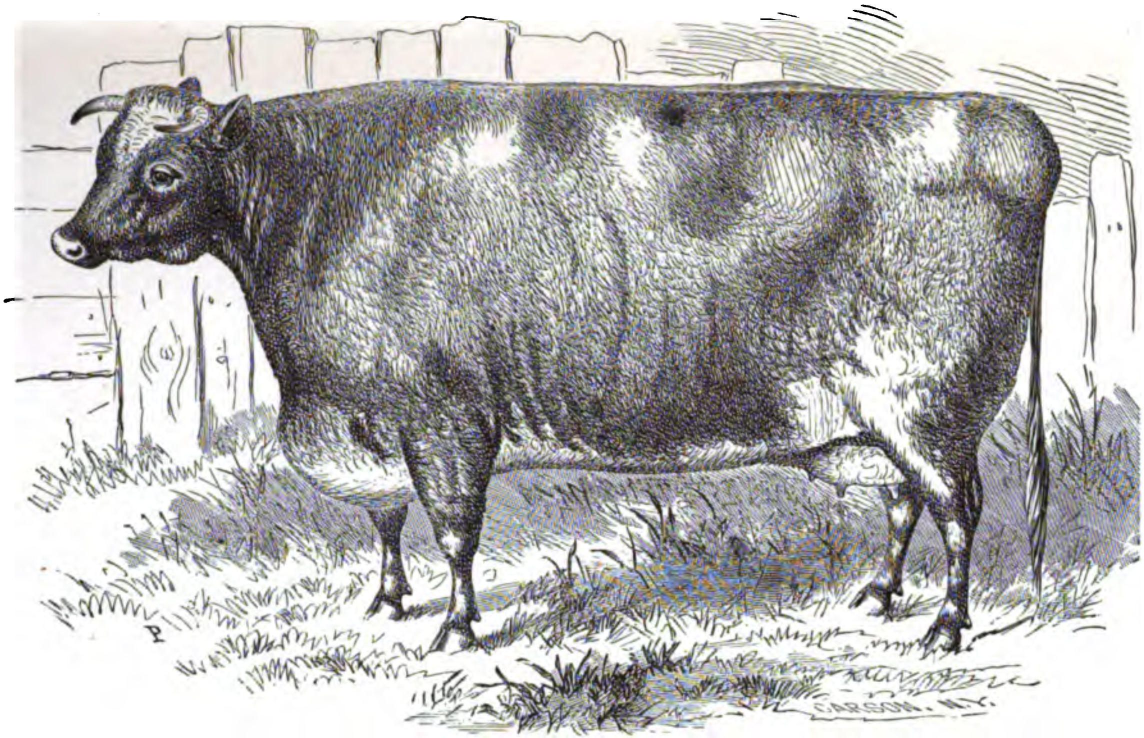
FRENCH NAPOLEON.

THE stallion French Napoleon was bred and raised by William McFarlan, of Downingtown, Chester county, Pennsylvania, and is five years old, stands sixteen hands high, and weighs, when in middling condition, fifteen hundred and fifty pounds. His color is a beautiful dark, dapple steel roan, with black upon the mane, tail, and legs. He is a fast traveller for a horse of his weight, of fine car-



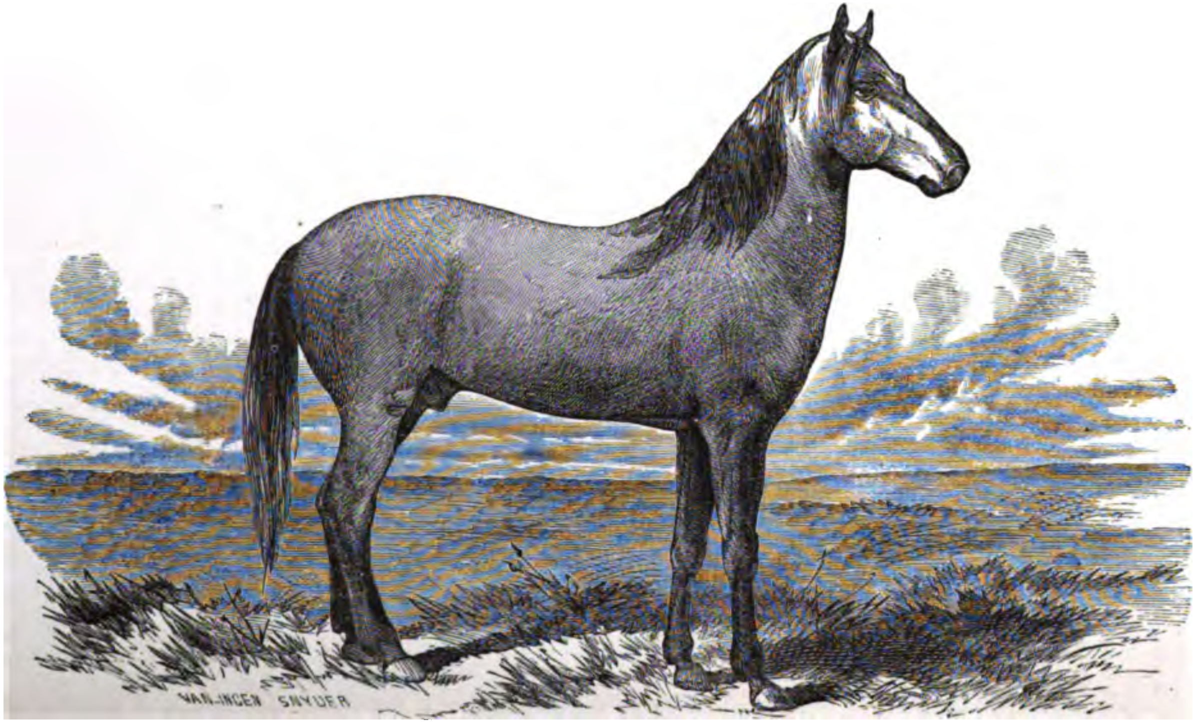
SHORT-HORN BULL. "THIRD DUKE OF GENEVA."

Bred by James O. Sheldon, Geneva, New York.



SHORT-HORN COW. "GEM OF OXFORD."

Bred by James O. Sheldon, Geneva, New York.



NORMAN HORSE "FRENCH NAPOLEON."

Bred by William McFarlan, Dowington, Chester County, Pa.

riage, kind and gentle in disposition. French Napoleon is one of the largest Canadian stallions in the United States. He was sired by Duke of Normandy—imported by Captain Hallman, of Chester Springs, Chester county, Pennsylvania—a horse which took the premium as a draught horse at the United States fair held in Philadelphia, the State fairs at Harrisburg, Norristown, Reading, &c. French Napoleon's dam was the fast travelling mare Byon Roan—owned by James B. McFarlan, of East Brandywine township, Chester county—she being sired by the far-famed Pilot Lyon horse, and he by the Pennsylvania Bell-founder. This horse, after a thorough examination by several of the most prominent and experienced horsemen, was pronounced the best horse in the country for the purpose of crossing with other breeds. This breed is not only noted for enormous bone and muscle, but also for kind disposition and quickness of action.

THE HORSE—FROM PRACTICAL EXPERIENCE IN THE ARMY.

BY COLONEL SAMUEL RINGWALT, OF DOWNINGTOWN, PENNSYLVANIA.

ORIGIN AND USEFULNESS.

The attachment of the Arabs to the horse has led their prophets to invent a fabulous account of his creation, which poetically expresses their admiration of this useful animal. Abd-el-Kader, in reply to the inquiries of the French government about the Arabian horse, thus described this fanciful theory: "When God wished to create the horse, he said to the south wind, 'I wish to form a creature out of thee—be thou condensed!' Afterward came the angel Gabriel, and took a handful of that matter and presented it to God, who formed of it a light brown or sorrel horse, saying: 'I have called thee Horse, I have created thee an Arab, and I have given thee the color *Roummita*, (red mixed with black;) I have bound fortune upon the mane which falls over thine eyes; thou shalt be the lord of all other animals; men shall follow thee whithersoever thou goest; good for the pursuit as for flight; thou shalt fly without wings; riches shall repose in thy loins, and wealth shall be made by thy intercession.'" Fossil remains have demonstrated to paleontologists that the horse existed, in the New as well as the Old World, before the flood. He traversed our soil as the contemporary of the mastodon; but while his race here became extinct, and he was unrepresented in the western continent at the time of its discovery by Columbus, in the Old World he was fortunately preserved. As he was specially designed for the use of man, he thrives best under man's protecting care, and renders incalculable service in meliorating the condition and promoting the interests of the human race. Barbarous tribes recognize his utility as readily as civilized nations, and he is even more indispensable to, and more highly prized by, the former than the latter. While the Indians of our plains have imbibed little or none of our culture, they learned to subdue the wild horses descended from the stock taken to Mexico by the Spaniards, and thus displayed the same ready appreciation shown by every people in ancient and modern times, and which has led to the diffusion of horses over nearly every habitable portion of the globe.

THE HORSE IN WAR.

The equine race furnishes the only animals generally useful alike in peace and war, and the horse is thus rendered an effective coadjutor in an infinite variety

of human pursuits. He not only aids in the labors of agriculture and commerce, but ministers to our social attachments and pleasures, while in war he is absolutely indispensable. No modern improvements would neutralize the advantage which one army possessing horses would have over another deprived of their assistance. The conquest of Mexico by Cortez was manifestly due chiefly to the terror inspired by his spirited barbs. Conflicts, upon which the fate of empire depended, have repeatedly been decided by the superior cavalry of the victors. "Sheridan's Ride" is famed in song and story; and, by winning a lost battle, he settled finally the long-disputed ascendency of contending forces in the valley of the Shenandoah. The raids of Grierson in Mississippi, of Stuart against the army of the Potomac, of Sheridan and the other commands in Virginia, and the rapid pursuit of General Lee after he evacuated Richmond, which made his surrender inevitable, and thus closed a long war, are but a few of the many illustrations furnished by the late conflict of the usefulness of cavalry. Waterloo was lost by Napoleon mainly on account of the failure, through accidents, of the impetuous charges on which he confidently relied for victory; and his enemies converted their triumph into an annihilation of the French army, by promptly impeding and harassing its flight. Frederick the Great, of Prussia, owed his brilliant military success, in a very large degree, to the marked superiority of his cavalry, as did before him Gustavus Adolphus of Sweden, Oliver Cromwell, Hannibal, Alexander, and many other renowned warriors. The defeat of an enemy is frequently of little consequence, if the advantage gained in the shock of battle is not speedily improved by a dashing charge. Artillery and infantry may sow the seeds of victory, but if cavalry does not reap its fruits, they remain ungarnered. In repeated instances during the recent conflict, sanguinary battles were rendered indecisive by the want of a sufficient cavalry force.

THE HORSES OF THE UNITED STATES.

The United States contain a much larger number of horses than any European country. In 1860 we possessed 7,434,681. A few years ago the horses of Europe were supposed to number 22,420,000; of Africa, 3,000,000; of Asia, 25,000,000; and of the world, about 58,500,000. So that we have more than one-eighth of the whole race. Our country has proved as genial a home for the horse as for his master. As we exceed all other nations in the number, so we have gained the questionable pre-eminence of an unprecedented variety in the breeds of our horses. Emigrants from Europe naturally brought with them, at different times, the animals with which they were most familiar. The Spaniards took to the southwest and to Mexico, whence they escaped into Texas and the plains, their famous barbs, which were formerly regarded as a superior breed, and which, in their best condition, are but little inferior to the Arabian. Some of the finest thorough-breds of England are derived from this race. The wild horses of our plains occasionally excite the warm admiration of critical observers. Washington Irving, in his "Tour on the Prairies," gives frequent expression to this feeling; and as the race is now disappearing as rapidly as the buffalo, one of that writer's descriptions may be appropriately quoted:

"On resuming our march we came to a little meadow surrounded by groves of elms and cottonwood trees, in the midst of which was a fine black horse grazing. Beattie, (a half-breed guide,) who was in the advance, beckoned us to halt, and being mounted on a mare, approached the horse gently, step by step, imitating the whinny of an animal with admirable exactness. The noble courser of the prairie gazed for a time, snuffed the air, pricked up his ears, and pranced round and round the mare in gallant style, but kept at too great a distance for Beattie to throw the lariat. He was a magnificent object, in all the pride and glory of his nature. It was admirable to see the lofty and airy carriage of his head, the freedom of every movement, the elasticity with which he trod the

meadow. Finding it impossible to get within noosing distance, and seeing that the horse was receding and growing alarmed, Beattie slid down from his saddle, levelled his rifle across the back of his mare, and took aim, with the evident intention of creasing him. I felt a throb of anxiety for the safety of the noble animal, and called out to Beattie to desist. It was too late; he pulled the trigger as I spoke. Luckily he did not shoot with his usual accuracy, and I had the satisfaction to see the coal-black steed dash off unharmed into the forest."

Indian warriors frequently attach as much value to their favorite steeds as the Arab to his fleetest courser. I saw a band of the Sac and Fox at Davenport, Iowa, some years ago, who, however ready to sell their inferior horses, refused tempting offers for their best animals. In fixing a price, one clap of the hands signified ten dollars, and when asked to designate the value of a superior horse, they would, after innumerable clappings, smile and shake their heads, saying *no shoneo*, (no money,) in a manner which clearly proved that they regarded him above all price. Among the tribes of the northwest the turf is a favorite institution, and in the official description of the Indians of Washington Territory, published in the first volume of the "Pacific Railway Reports," it is stated that "at certain seasons the Klikitats descend to the Yahkohtl, Chalacha, and Tahk prairies, where they are met by the Yakimas, who assemble with them for the purpose of gathering a late species of berry, and of racing horses. The racing season is the grand annual occasion of these tribes. A horse of proved reputation is a source of wealth or of ruin to his owner. On his speed he stakes his whole stud, his household goods, clothes, and finally his wives; and a single heat doubles his fortune, or sends him forth an impoverished adventurer. The interest, however, is not confined to the individual directly concerned; the tribe share it with him, and a common pile of goods, of motley description, apportioned according to their ideas of value, is put up by either party, to be divided among the backers of the winner." The same authority gives an account of the horses of the far northwest, which is probably true in most respects of the Indian horses of all other sections, in saying that "some of the horses are of fine form and action; but they are generally injured by too early use, and sore backs are universal. Indiscriminate breeding has greatly deteriorated what must have been originally a good stock, and the prevalence of white and gray in the color is a great objection. Wall eyes and white noses and hoofs are more than common among them. They are almost always either vicious or lazy, and usually combine both qualities. In their capacity for continued endurance they are overrated. A good American horse is as much superior to them in this as in speed; but they are hardy, and capable of shifting with but little food."

The Germans of Pennsylvania displayed a preference for heavy draught horses, which led to the development of the Conestoga breed, resembling the Flemish and Danish horses, or the English Suffolk Punch. The old English breeds were naturally taken to all the colonies, and were as naturally succeeded in some sections by the thorough-breds, after their superiority was recognized in the mother country. Different French breeds were transmitted to us through Canada, as well as by direct importation; and we have also imported Arabian horses, ponies, and almost every known species of European stock. Meanwhile we have developed, as an original American breed, a race of unequalled trotters and roadsters, and subjected to every conceivable cross all our varied stocks. These indiscriminate intermixtures, while they may prove advantageous in some instances and for special purposes, have tended to the obliteration of pure breeds; so that, except in the case of a few well-known thorough-breds and renowned trotters, we are losing sight of the native standards, from which alone certain results in breeding can be obtained. It is naturally the aim of each community to procure such horses as are best adapted to its peculiar wants, and in seeking this end, national purposes and the preservation of pure breeds are disregarded by breeders generally, unless some strong counteracting influence is brought into

active operation. The race horse and hunter minister to the pride of the aristocracy of England. The trotter in our northern States, where long lines of good roads must be travelled in carriages, becomes a great desideratum; while in the southern States, with comparatively few good roads and few light wagons, the desirability of swift and spirited saddle horses perpetuated the old preference for thorough-bred stock. The farmer requires a combination of qualities. He needs strength, but not so much as the drayman demands; he is not indifferent to speed, because he must take his animals from the plough or the cart to the carriage or light wagon for occasional journeys; but he does not require the fleetness of either the blooded courser or the fast trotter.

When the government, at the commencement of a great war, suddenly made an extraordinary demand for horses, the northern States were able to supply it by judicious selections and the necessary training for almost every purpose except mounting cavalry regiments, in the requirements of which, as the results proved, the common breeds of northern horses were sadly deficient. We had uniformly associated the idea of speed with trotting, and neglected the easy gaits which alone can give the cavalryman the steadiness and command over his weapons which are essential in war. It was bad enough to have poor riders, but especially embarrassing to rely upon them to train animals which had neither inherited nor been taught the necessary movements. The lamentable inefficiency of our cavalry in the early days of the war, when the southern cavalry, consisting of riders and horses well trained to many of the requisite duties before the contest commenced, was the glory of the opposing army, can easily be traced to these causes.

ACTION OF EUROPEAN GOVERNMENTS.

It was thus clearly shown that the breed of horses may become, in grave exigencies, a matter of great national importance, and that ordinary civil purposes may be served by animals not fully adapted to the requirements of war. European governments are accustomed to the practical recognition of this fact, and systematically evince a deep solicitude for the improvement of horses for military purposes, as well as for the advancement of agriculture.

The French government formerly purchased every year a number of the stallions of the best native breed, (the Normandy horses,) and sent them to other departments for the improvement of the inferior breeds. Government studs for breeding cavalry horses have also been established. The example of England in opening a stud-book, in which the names of all thorough-breds are recorded, has been imitated. Races have been instituted, the best English thorough-breds purchased, and the influence of the Emperor in stimulating the improvement of French horses has been strongly exerted, with great success. The French cavalry has always been badly mounted, except those regiments which, like the chasseurs d'Afrique, (who are furnished with African barbs,) obtain their horses from points beyond the limits of France, and Louis Napoleon is no doubt anxious to remedy this deficiency.

Austria has organized large imperial establishments for the propagation of a superior breed to be distributed throughout the country, for agricultural purposes as well as the supply of military demands. One of these, which is a type of others, is located on a fertile tract of 40,000 acres of land. One thousand brood mares and forty-eight stallions are constantly kept, in addition to the horses and oxen necessary for the general management of the estate. When colts attain the age of four years they are examined and classified. The best are retained to preserve and perpetuate the excellence of the stock of the establishment; others are sent to different parts of the country and sold, for the improvement of the native breeds; many are sent to the army, while those possessing no particular excellence are sold at auction for general purposes. The imperial treasury

advances to the establishment $60,000 per annum, but is reimbursed by the sale of 150 stallions annually for $500 each. Although more than 1,000 men are employed, the estate is made self-sustaining by the revenue above described, together with its receipts for army horses, viz: for the light cavalry, $55; for the dragoons, $60; for the cuirassiers, $70; for the train, $80; and for the artillery, $90. A few years ago these studs could furnish 5,000 five-year-old cavalry horses per annum.

Prussia also maintains several extensive and well-regulated government studs, in which particular attention is paid to the cavalry horse.

Russia formerly maintained government studs, but as the horses were suffered to run wild, too much trouble was experienced in training them when sent to the army. The late Emperor Nicholas established races in various parts of Russia, and adopted other methods for the improvement of the breeds of that country.

The Duke of Augustenburg greatly improved the horses of a portion of Denmark by forming a stud that contained thirty mares and fifteen or sixteen stallions of the best thorough-breds of England. From the latter he developed a race well adapted for the general purposes of pleasure, commerce, or agriculture, by allowing such stallions as he deemed best suited to the stock of the surrounding country to be used gratuitously, having in view the purposes for which colts were designed and the qualities of both parents.

In no country has so much attention been persistently paid, through a long series of years, to the improvement of horses by the government, as in England; and the excellence of the English stock is manifestly due to this lively interest and effective aid. From time to time the best horses of all countries have been imported by British monarchs. Parliament has made annual appropriations, either for such purchases, or as a premium to the winners of great races, and Henry VIII did not hesitate to adopt the arbitrary measure of destroying all the inferior horses of the kingdom to prevent the propagation of their species, and to elevate the British standard. He suffered no stallions below fifteen hands, and no mares below thirteen hands, to be kept. Great care is bestowed upon the selection of English cavalry horses. The animals trained for fox-hunting purposes furnish a useful stock from which to obtain remounts, but even their general excellence is not deemed sufficiently reliable, and in order to insure horses not worked until they are five years old, likely three-year-old colts are bought and kept by the government until they attain the requisite age before they enter the service. This practice is also followed in Prussia.

The question is worth considering, whether our own government might not find something in these examples worthy of imitation. Even if military purposes, strictly, are considered, they are worthy of attention, and the general improvement of our breeds of horses is an object of immense importance in view of their great pecuniary value, and their usefulness in time of peace and war.

HORSE BREEDING.

The lesson taught by the war, of the superiority of blooded horses for cavalry purposes, should certainly not be neglected or forgotten by the people. In the improvement of our inferior breeds, special attention should be paid to the selection of mares, as there is great virtue in the old Arabian rule, which attaches even more importance to the qualities of the dam than to those of the sire. Sound, vigorous, and good mares should always be chosen. The prevailing idea that the breeding properties of mares should be exercised when they are old and unfit for service, is erroneous and prejudicial. The proper working season of the stallion is from the first of April to the first of August. The average period of gestation in the mare is about eleven months, varying about two weeks, the time on an average being two weeks longer in bearing a male than a female foal. During the time of pregnancy the mare may be worked or ridden gently, but

should be fed with four quarts of oats daily, and as she approaches near to foaling she should be turned to grass, and if the grass is scanty, should be fed with meal. In a month after giving birth to a foal she can be worked or ridden moderately, but great care should be taken not to overheat her, nor to keep the foal too long away from her, particularly if she has a full flow of milk. Foals should be taken from the mares when from five to seven months old.

During the first winter colts should be permitted to run at large, and only housed in bad weather. They should not be fed much strong grain, as their eyes and limbs often suffer therefrom. The same treatment should be observed the second winter. In the summer they should be turned to grass. The third winter they will require more grain, particularly if it is intended that they shall begin to earn their food.

The stallion selected for a sire should be as compact as possible. A long belly and a short back, a yellow eye and a thick thigh, have been considered pretty good marks. It should be, if possible, so paired with the mare that the good points of each may be preserved, and the defects, if any exist in either animal, may be counteracted by opposite qualities in the other.

The foal of a full-blooded dam got by a pure Normandy stallion will generally prove a more useful and valuable horse for all practical purposes than any other cross; and among the valuable blooded animals of our country, my observation has led me to place in the front rank, for stamina, speed, endurance, vigor and strength combined, the old Messenger stock.

JUDGING HORSES.

In judging horses everything depends upon the use for which they are intended—whether in time of peace for farming purposes, roadsters, hackneys, passenger railways, cart or dray or family horses; or in war, for commanding and staff officers, cavalry, artillery, ambulance or teaming purposes.

In the first place, the person or persons selected as judges should have had considerable experience. Science and theories, while of incalculable value in the food, treatment, and diseases acquired by horses, are of comparatively little value in judging their soundness. The horse is sound when free from disease and such malformations as may impair his natural usefulness. Horses intended for the government service were examined and judged by inspectors appointed by the Secretary of War for that special purpose.

On examining a horse that promises to answer your purpose, after satisfying yourself that he is sound, study his physiognomy as you would that of a man with whom you desire to become associated. Look fairly and squarely into his eyes. As the eye of man is the index of his soul, so by the eye of a horse also, all other things being right, you can form a pretty good idea of his character. By comparisons, too, we often obtain our most useful knowledge. Being satisfied on the points named, you next proceed to examine his mouth to ascertain his age, the general rules for which are as fully explained in the standard books on horses as they possibly can be in written descriptions; but oral instruction by an experienced horseman, accompanied with the examination of many living animals, is the surest and perhaps the only way that the necessary information can be conveyed in regard to the proper method of ascertaining either the age or the general qualities and defects of a horse.

SELECTING HORSES FOR THE ARMY FROM GOVERNMENT CORRALS.

An important and arduous duty, requiring considerable experience, energy, and judgment in selecting animals for the different grades of service, necessarily devolved on persons having this charge. Fancy to yourself a corral enclosing perhaps 2,000 horses of all ages, sizes, and colors, where, in the first instance, a

cavalry officer selects perhaps one or two hundred horses for that branch of the service. The artillery officer next approaches and makes his selections, amounting to a similar number. The quartermaster, who is intrusted with the transportation of the army, and who provides the quarters, storage, and transportation for army clothing, camp and garrison equipages, cavalry and artillery horses, fuel, forage, straw material for bedding, stationery, &c., generally gets the last choice. In filling a requisition for 100 four-horse teams, he is assisted by that number of teamsters, whose first object is to get horses matched in color and size as nearly as possible, without reference to age, durability, disposition, or action. In very few instances can the quartermaster indulge them in their fancies. For a leader in a four-horse team it is best to select an animal that shows marks on his shoulder of having drawn against the collar, with a broad forehead and a quirl or rose under his foretop, indicating sagacity and vigor. For a saddle horse, as in many instances he must carry the weight of the teamster, you require a well-proportioned animal of muscular power and gentle disposition. Being provided with a reliable leader and a trusty saddle horse, the off leader and the off wheel horse can be readily supplied. To break a horse fitting for a leader, for a single line, shorten your leading rein several inches on the near or left side of the horse. When you require him to go to the right you give a few sharp jerks to the line, which will make him yield from the bit and incline to go that way, while a straight pull on the line will make him incline towards you. Suiting the action to the word you can in a short time accustom him to go to the right or left by the words, "gee" or "haw."

ON THE RELATIVE POWERS OF ENDURANCE FOR THE DIFFERENT KINDS OF SERVICE OF THE SEVERAL CLASSES OF ANIMALS DURING THE WAR.

Horses selected for the cavalry branch of the service should have been chosen with regard to their breed, fleetness, size, weight, compactness, muscular power, gait, courage, and gentle dispositions. This proper combination of qualities was difficult to obtain from northern horses. I am free to say blood told the tale. "The noblest conquest ever obtained by man was over this proud and spirited animal, which shares with him the fatigues of war and the glories of battle. The horse, not less intrepid than his master, sees danger and defies it; he inures himself to the din of arms; he delights in it, seeks it, and is animated with an ardor equal to that of man." For cavalry service, commanding and staff officers and mounted signal officers, the English or blooded stock of horses is undoubtedly entitled to the preference. Stallions, for speed and endurance, have on all trying occasions evinced a decided superiority over geldings.

It must be admitted, despite our preference for thorough-breds for cavalry, that we have a native breed which for all merely practical purposes is superior to the English stock, and, for artillery, has no equals. I allude to the Justin Morgan stock. Lacking the gait of the English bred horse, having been trained to trotting for generations back, this deficiency is inherent. For the movements of an artillery corps, their gait is well adapted. Their symmetrical form, compactness, vigor, strength, and powers of endurance excited much admiration, and the prices asked and paid for them proved the estimation in which they were held. In some batteries, however, I noticed remarkably fine looking horses, particularly at the tongues of the cannon and vehicles in constant use. They were of good size, and reminded me of the Conestoga and the old Esopus and Pilot Lion breed, while their great weight assisted them in pulling the ponderous loads through mud and mire. I thought their action was too slow for the quick and lively movements of battle, nor could their powers of endurance be depended on when food became scarce and they were subjected to hard usage.

The team or wagon horse next comes up in regular order. Under another

head I have mentioned how horses are selected from government corrals. The best horses were chosen for the cavalry, the next best for artillery, and the last and worst for teams. The idea was therefore fully carried out that when a horse is unfit for any other purpose, he will answer, or must be made to answer, for a team horse. And to teamsters were left horses of all ages, sizes, and colors, mongrels which had lost their identity, raised in low marshy lands, where feed was plenty and freely given when young, with flat feet, beef heels, swollen legs, sore eyes, and distempered noses, walking bears and elephants that carried the produce of rich farms to market, and that, like Pindar's razors, were only made to sell. As these evils rapidly increased, the more horses of this kind the government procured the more the service suffered.

There were, however, many exceptions to this general rule, of such horses as had been fed and reared in dry, light, and hilly grounds, producing temperate, swift, and vigorous foals, with muscular legs and hard hoofs, not fed with much grain when young, and not brought into the army before they were six years old, having been previously trained to work in the plough or wagon, and sometimes for pleasure driving, and weighing from 1,100 to 1,300 pounds. These could be relied upon for service and endurance.

But the transportation of the army only became effective when we became rid of the pests I have described. They were finally sold at government sales at from one-fifth to one-tenth of the original cost. The horses thus disposed of were principally three, four, and five years old.

Mules were then introduced, and rendered efficient service, eclipsing the endurance of the horses; but usually a six-mule team was only equivalent in strength to a four-horse team. No horse should be purchased for immediate use as a team, cavalry, or artillery horse until he has arrived at the age of six years, when, among experienced horsemen, he is called a horse instead of a colt, and has what is called a full mouth. What may be considered as rather singular is nevertheless true, that a three-year old colt will endure more fatigue and hardship than a four-year old, and often more than a five-year old. The government suffered perhaps more from admitting horses into the service under a proper age than from all other causes. Certain it is that the efficiency in the transportation department was very much and very often impeded thereby.

Mares, when they must be mingled with horses in the field, are troublesome, and in many instances were regarded as nuisances.

FAULTS AND VICES.

The two greatest faults of horses in ordinary use are shying and stumbling. The first can often be attributed to confinement in a dark stable, or very long hairs growing out a short distance below the lowest eye lashes. The removal of such hairs, either by pulling them out or clipping, will often remove the last-named cause, and the first can be remedied by admittance of more light. A very bad practice exists among horsemen of whipping and forcing an animal to pass an object at which he shies, before his natural instinct permits him to discern what it really is. By forcing and whipping him you only increase the evil, whereas if you give him time to view the object the evil in a great measure will be remedied. Stumbling can be attributed to weak knees, improper shoeing, stiffened shoulders, chest founders, sore back, and, last, foul sheath. To effectually guard against the last-named cause, great care should be taken in having the sheath washed and well anointed with clean lard, (without salt,) at least once every year, and then by an experienced hand who can reach the vital point. The other causes named will not often occur if the horse is properly treated, and care taken in the purchase of a sound animal. Cribbing must be considered a vice, and not an unsoundness, and one not generally witnessed with much pleasure but rather with disgust. The vice can be remedied by pulling a leather

strap around the horse's neck pretty tight, in such a manner that he cannot suck in the wind. A sheepskin nailed on the box or trough where he eats his food is a good remedy, as a horse in his dainty taste is averse to everything appertaining to flesh. I have been successful in curing horses of this trick or vice by burning the inside of their mouths, along the inner upward range, as if to cure lampas. I conceived the idea that a horse must have some cause for cribbing, and that it might be a tickling sensation in his upper nippers, or from pain in that region. Kicking and biting are also bad habits, for the cure of which there are many remedies described in treatises on the horse.

TREATMENT.

This is a subject which, above all others, is entitled to serious consideration. From the most reliable information to be gleaned, a horse in a state of nature, when in a full and unrestrained flow of animal spirits, bounding over the prairies, providing his own forage, and supplying his own wants, is not subject to many of the diseases which he contracts after he has become subservient to the hand of man. The contrast between his noble bearing after he is domesticated, when he is turned loose to roam and play, and the spiritless, jaded, and submissive appearance which he presents under the ill treatment of a careless cavalry, artillery, or extra duty soldier, or slovenly farmer, an ignorant savage, or an intoxicated teamster, is revolting to every benevolent mind. "A righteous man regardeth the life of his beast," is a divine precept on which the human law is presumed to be founded. If all instances of its violation could have been rigorously and summarily punished, government would have saved millions of dollars, and thousands of horses that met an untimely end might now be actively and usefully employed.

It would be, however, highly improper and unjust to attribute all the ills of horse-flesh to neglect or ill treatment. It must be apparent to every reflecting mind, that the allowance under the Revised Regulations for the Army for forage rations, viz., fourteen pounds of hay and twelve pounds of oats, corn, or barley, is not sufficient to properly sustain a horse for the arduous and trying duties of an active campaign.

As my mind has been fully occupied when on the tented field with this subject, I have searched in vain for an example to justify our otherwise liberal government in the distribution of the scanty rations for horses. The horses purchased for actual service were generally obtained from States and localities where grain was abundant, and at low prices, and they were not stinted in food. Very few horses that are in use, either for pleasure or business, are restricted to a daily supply of twenty-six pounds. Forty pounds would be much nearer the mark. The horse was deprived of many comforts. Shelter, mangers, boxes, and bedding were exchanged for the open sky, the lariat, nose-bag, and mother earth, and he therefore required more than his usual amount of food to sustain his wonted vigor, while he was obtaining less. The horses in the army also suffered in many instances for the want of salt, and as there was no provision made for it, soldiers who knew its importance took the rock-salt used in salting bacon, but as the horse has a very dainty palate it was used very sparingly. The horses suffered for the want of proper treatment; perhaps the more from the fact that many of their riders and drivers had had very little or no experience in horsemanship, grooming, or feeding, than from any other known cause. And the exigencies of the service often prevented them from bestowing that care and attention which health and vigor required. The injunction—

> "Up hill bear him, down hill spare him,
> On the level let him trot, and in the stable forget him not,"

would have been impracticable in many instances. Very few injuries occur to horses from excessive labor and fatigue, if they are properly treated in the stable

afterwards. The state of his body should be well examined, and if too warm, he should be blanketed and guarded against sudden chills, and no feed or water administered until he is perfectly cool, and then only in small quantities. There is perhaps nothing that conduces more to health and strength of the animal than a good rubbing with a wisp of straw or hay, and hard hand-rubbing, which converts flesh into muscle. The curry-comb and brush are only sufficient to rid him of the dust. These applications should be continued daily whether the horse is in use or not, with gentle exercise. The finer the animal the more care and attention he will require, more particularly if you value his speed and good appearance.

As hay forms the greatest component in the rations of a horse, care should be taken that he has it at proper intervals, and particularly should the quality be well scrutinized. Mow-burnt hay, or that which has become so old that it has lost its nutritive and saccharine matter, is injurious, and even poisonous. The use of it produces hide-bound, wastes his strength, and causes excessive thirst. Great care should be taken not to let a horse suffer too long for the want of water. On being taken out, either for labor or to be ridden, he should at first be used moderately, not urged. Otherwise, with a full stomach, in fast riding or driving, particularly against a hill, you may impair his wind, destroy his digestive powers, and perhaps injure him for life.

FOOD.

It frequently occurred in the army that the usual provender composing the forage for a horse could not be obtained, and we were compelled to resort to standing grain, such as wheat, rye, corn, oats, barley, and, in some instances, to beans and clover hay. When this was the case, some judgment was required in regard to the quantities in which such food should be distributed. Herbage, green and dry, constitutes a principal part of the food of the horse. The different grasses that form hay, coming to perfection at different periods of the year, are mowed and cured when some are too ripe and others too green, thereby forming an inferior quality. Farmers have been negligent in sowing and permitting too many different grasses to grow together in which there is no assimilation. Clover and timothy can grow on the same land, to better advantage than any other seeds, although the former ripens much earlier than the latter. This, however, is, to a very great extent, only the case in the first season of mowing, as the timothy eventually eradicates the clover, and it is then that pure timothy becomes the most useful and valuable hay for horse-feed.

Clover must, however, never be lost sight of. Without exception, it is the great fertilizer of the land, the cheapest and the best. The hay it produces, if properly cured without injury from rain, and cut without being too old, may be ranked as the most nutritious of all herbage for horned cattle. The effect it produces on old and worn-out soils, by its roots penetrating the ground and thereby enriching the soil, is astonishing. The farmers of Virginia have placed implicit reliance on clover as food, hay, and for pasture; and it is perhaps not too much to say, that in the land-killing system which has been practiced in the sunny South, to the sowing of clover seed, and sometimes ploughing it down when fully grown, they owe their lives and living more than to any other cause.

On the greasy bottoms of the Shenandoah, Rappahannock, Pamunky, James, and other rivers, where the fertility of the soil happens to be almost inexhaustible, I have been surprised that farmers have not turned their attention to the formation of timothy meadows, particularly when the South relied, in time of peace, for that article upon the North.

Baled hay was principally used for horses in the army, and mostly of an inferior description, not much regard having been paid to its quality; besides, it was frequently injured, by transportation on open vessels, by rain or bilge-water

As hay is one of the great compounds in the rations, it should not be fed before it has undergone fermentation, nor should it be allowed to become so old as to lose its nutritive and saccharine properties. In the former case, it is too purgative; and in the latter, dry, tasteless, and unwholesome.

The system of manger-feeding is becoming more general among farmers. If proper care is not taken, many horses will waste as much hay as they eat, by culling the best part and trampling the balance under foot, which would not be the case if hay was placed in a rack. The economical way of feeding hay, corn fodder, straw, or chaff, would be for farmers and others to provide a good hay cutter and crusher, and to place the provender in a box, pouring sufficient cold water on it in summer, and hot in the winter, to dampen it, and then mixing with it sufficient meal, and to make it palatable by adding a few handfuls of salt. A proper regard should be had to the expenditures for food. When hay is selling at $40 per ton, and corn and oats at less than two cents per pound, the meal should be increased and the hay diminished. Bran or ship-stuff can frequently be used as a substitute for corn and oatmeal, or mixed with it to considerable advantage. It may be proper here, before the different kinds of food for a horse are enumerated, to give a list of the quantities of nutritive matter contained therein; for although these quantities cannot be considered as expressing the actual value of each, because other circumstances seem to influence their effect, in supporting the strength and condition of the horse, yet many useful hints may be derived from it by the farmer, when he considers the produce and capacities of his soil. I take it partly from the list of Sir Humphrey Davy's Agricultural Chemistry: 1,000 parts of wheat contain 955 parts of nutritive matter; barley, 920; oats, 743; peas, 574; beans, 570; potatoes, 230; red beet, 148; parsnips, 99; carrots, 98. Of grasses, 1,000 parts of meadow, (cat's tail,) 98 parts of nutritive matter; other grasses averaging about 75. Cabbage, 73; common turnip, 42; long-rooted clover, 39; white clover, 32; lucerne, 23. From this we might infer that timothy hay contains at least a common average, and that corn and rye contain an average at least between wheat and oats, if not a greater amount. It is supposed by horse-men that unground rye, say three pints a day, fed to a stallion, will impart more vigor, particularly during the season of service to mares, than any other grain. A handful or two of hempseed, fed daily at this season, I have also found to be of practical value.

Oats have been selected and are considered the proper food to afford the principal nourishment for the horse, and, as a general feed, are preferable to all other grain, more particularly for cavalry horses and for horses which require fleetness, endurance, and wind. Much care should be taken to obtain oats of the best quality, which may readily be tested by their weight. The standard in Pennsylvania is 32 pounds per bushel. In fertile soils the average weight falls far below this standard; in the sterile or lighter soils, it invariably comes up to the standard. The weight of oats is also, to some extent, regulated by climate. In the glades of Pennsylvania, they frequently weigh from 36 to 45 pounds to the bushel. I have obtained and sowed the glade oats in Lancaster and Chester counties, Pennsylvania, and have always found that, in a few years, they deteriorate in weight and become little better than our own. Oats should be old, heavy, dry, and sweet; mow-burnt or musty oats should be carefully avoided, as their use, particularly in the army, would prove very deleterious to animals, not only failing to strengthen them, but, in many cases, producing diseases and unfitting the horse for actual service. In endeavoring to remedy this evil, I have frequently traversed the country surrounding our camp in search of oats in the straw or stack, and if, upon careful examination, it was found to have been cut at the right time, and to have a sweet odor, I would purchase and distribute it among teamsters, and the artillery and cavalry corps. On several occasions I procured threshing machines, fed the oats, and distributed the straw among the different hospitals, to be used as beds for the faithful soldiers to rest and warm their

weary limbs. Oat-straw, for feed, is considered better than barley-straw, but does not contain so much nourishment as that of wheat. The ration for a horse, as I have observed under another head, is 12 pounds of oats, corn, or barley, and 14 pounds of hay. It was very difficult sometimes to obtain a sufficient quantity of oats, and corn, which formed the substitute, had to be relied on, not from choice, but necessity. Barley was seldom used. I have often been surprised at the refusal of teamsters and artillerymen to feed corn instead of oats, to which, pound for pound, it is preferable for horses intended for slow movements in cold and inclement seasons. The principal supply of corn was obtained when in winter quarters. An order would be issued directing the quartermaster to cut all the corn standing within a certain circuit, stack and distribute it as near as possible according to regulations, using the fodder, to a certain extent, for hay. In localities where extensive flouring mills had been or were in operation, large quantities of mill-feed could be generally obtained. The bolting-cloths in the most of these mills were used for manufacturing extra fine flour, and what, in our part of the country, was termed bran, ship-stuff, and middlings, became mixed in a general mass, as mill-feed, weighing from 34 to 35 pounds to the bushel. When the government was paying from 75 to 80 cents per 32 pounds of oats, it did not require much discernment for an old farmer and miller to make large purchases and distribute equal quantities of mill-feed and oats, particularly among the teamsters and others, who were provided with boxes and troughs to mix and water the feed. Very few vegetables were used. Potatoes, cabbages, turnips, &c., were considered as more and better suited for the subsistence of soldiers, and, like poultry, were indiscriminately devoured without regard to ownership. Wheat is seldom used as food for the horse, its price being generally much higher per pound than any of the other cereals. When farmers, however, have damaged or unmarketable samples of wheat, it is sometimes ground for horse feed. When the price is low, say seventy-five cents or one dollar per bushel, and corn and oats higher in proportion, wheat may be economically used. The fact is not generally known that wheat ground and properly mixed with clean rye straw, or a pure timothy hay, cut from a half-inch to an inch long, and watered sufficiently to make the meal all adhere to the straw or hay, in quantities say from five to seven pounds, three times every day, will impart a finer skin and color to the horse than any other food. Rye should, when ground, be used in the same manner. Wheat and rye, when ground, must not be fed to a horse without being mixed with hay or straw, as the meal adheres to the roof of the mouth, or, when swallowed, will clog in his stomach. While wheat contains more nutritive matter than any other grain, it also contains a larger proportion of gluten, or sticky, adhesive matter; and while it beautifies and makes a horse look more sleek and smooth than any other food, it must not be relied on when animals are intended for hard labor, either on the farm or service in the army. Clean, dry, heavy, sweet oats, mixed with one-fourth sweet, parched corn, well sifted, free from dust, with little hay, making up the deficiency with grain (in kind,) is the proper feed for a horse used in the cavalry service, or when speed and endurance are required. The horse, for labor on the farm, for teams or artillery service in the army, requires more bulk and weight in his food, as he trudges along in his daily toil.

DISEASES.

Many of the diseases by which horses become afflicted can be attributed to the exposure which they necessarily encounter, scantiness of food, imperfect or no grooming, watering and feeding when too warm, suffering too long for food and water, and then from a want of proper judgment in the distribution. Many others may properly be attributed to want of proper rest. A horse being a watchful animal, easily awakened, and seldom caught napping, even in the still

hours of midnight, it may readily be supposed that very little of his time is consumed in nature's calm restorer, sleep. This leads us to suppose that from his conformation he requires very little; but the constant noise of a camp life interferes with the small amount of rest and sleep that is essential. It is asserted that some horses never lie down, but sleep while standing. This is the case sometimes, but certainly only to a very trifling extent. The fact is well established that all animals only increase in flesh and fat when lying down; and, on the other hand, lose the same in the arduous tasks which they are required to perform. Therefore, to the loss of proper rest and sleep may, in a great measure, be attributed the wearing out and premature death of many horses.

On our onward march to Richmond, after passing the formidable fortifications at Centreville and crossing Bull run, we soon came within sight of the plains of Manassas. It was a favorite and mistaken idea to encamp on the grounds deserted by the enemy, who had destroyed by fire all property of a combustible character designed for the use of man or beast, and carefully left behind all diseased and worthless animals. On arriving at our place of encampment I reported to the commanding general that I had observed a number of horses infected with that horrible and contagious disease, the glanders. The cold lead was soon applied to some of them, and they were despatched. The disease, however, formed subjects for courts of inquiry and inspection. When the commanding general became acquainted with the facts he issued a peremptory order to have all the horses infected with the disease shot, and, at my suggestion, approved a requisition for a large amount of assafœtida, which was applied to the bridle-bits of horses in the service, and others were required to have their watering buckets well saturated with that disinfectant.

A horse sometimes passes through different stages of disease before it finally ends in glanders; the first of which may be called mud-scald or hoof-rot, the second farcy, and the last glanders. There are, however, three distinct kinds of glanders. The principal diseases that came under my immediate notice while in the army were colds, colic, distempers, and those just named; but as I do not wish to invade the province of the veterinary surgeon, I shall not dwell upon their proper treatment.

THE FALL OF THE HORSE.

I know no better way of closing this discussion of the usefulness and treatment of the horse than by copying the following description of the numerous purposes to which his carcass is applied in European cities: "When the horse falls he is bled, and his blood is preserved for the use of the dyer; the mane and tail are next cut off for the manufacturer of sieves, hair-cloths, and bow-strings for the violin; the shoes are taken off for the nailer; the hoofs are cut off for combs of various kinds and other horn work, and a portion of the feet goes to the gluemaker; the skin is stripped off for the tanner, who converts it into excellent leather for boots, harness, &c., and the collar-maker finds it, in its rough state, the best material for cart harness. The flesh is then cut up for the carniverous beasts in menageries, or for dogs; and, though without knowing that there are (hypophagi) a club of horse-eaters, who regularly advertise their club days, some of our fellow-creatures are regaled in the cheap eating-houses of great cities with delicate bits of carcass, in the form of *patés*, pretended beefsteaks or soup. When the flesh and fat have been removed, the stomach and intestines are laid aside for machine straps and strings for musical instruments, and are often sold for the latter purpose as the best Naples cords; the ribs are turned into buttons and children's toys; the larger round bones serve for tweezers, whistles, ferrules, knife-handles, cups and balls, dominoes, &c., and the large flat bones are of use to the toy men for many things; even the teeth are useful when polished for the dentist, and for many purposes for which iyory is usually required. The bones

of the head are either consumed in heating furnaces or crushed into dust for manure. The remainder of the carcass is burnt, and by this process it produces ivory-black, soot-black, and valuable manure; and from the fat is extracted a coarse oil, which is used by mechanics."

"IMPROVED KENTUCKY SHEEP."

BY ROBERT W. SCOTT, NEAR FRANKFORT, KENTUCKY.

THE sheep which are called "native," or "common," in the west, are a hardy and prolific variety; but they are deficient in size, in thrift, and in fleece. Though the general diffusion of them proves their adaptation to the circumstances in which they are placed, yet it is well known that the tendency which all animals have to adapt themselves to climate and subsistence may be materially modified and controlled by judicious crossing, and that the improvement made by these crosses becomes permanent, and thereby stamps distinct varieties of the same class of animals. Chiefly by these influences (crosses, climate, and subsistence) the Bakewell, Oxfordshire, Saxony, and other varieties of sheep have been produced; and their distinctive features, in congenial localities, are as indelible as those of the stocks from which they were produced. In the same manner, no doubt, still other varieties may be produced; nor does there appear to be any insuperable difficulty in blending, in the same animal, any number of valuable qualities which are not actually antagonistic to each other. These principles extend even to points of fancy merely. For example, some breeds of sheep are hornless, while others have two, others three, and others still have four horns. The Syrian shepherd delights in a breed whose tails are so long and fat that wheels are required on which to draw them over the pastures; but we prefer sheep with short tails, and perhaps a breed might be produced as destitute of them as are dogs of some breeds.

There are other valuable considerations which make the frequent crossing of sheep desirable, if not indispensable. Dr. G. H. Dadd, in his American Cattle Doctor, page 248, says: "It is now a well-ascertained fact that health and vigor can only be perpetuated by not running too long on the same blood. The best variety of sheep I have ever known (putting fineness of fleece aside) was the mixed Bakewell and South Down." Sir Robert Smith, in his prize essay for the English Royal Agricultural Society, says: "Having tried experiments in every possible way, I do not hesitate to express my opinion that, by proper and judicious crossing through several generations, a most valuable breed of sheep may be raised and established."

The tendency of all improved breeds of all domestic animals to relapse to their original status when they are neglected or abused, is no proper discouragement to this course of improvement, for such a policy would condemn the adoption of all our best breeds of horses, cattle, sheep, and hogs; for all have been produced by careful and judicious crossing and selection, and all improvements in stock can be fully maintained only by a reasonable share of the same care and judgment by which the improvement was originally effected.

None of the previously existing breeds seemed to possess all the requirements of sheep for the great west and south; the native sheep were inferior in carcass and in fleece; the Cotswolds were too delicate, when young, to bear exposure to our wet seasons; the fleece of the South Down was too short, and the Merino was

too small. Acting on these impressions, the writer has perseveringly endeavored for over thirty years, to combine in the same animal the hardiness and prolific quality of the native sheep, the size and weight of fleece of the Cotswold, and the symmetry of form and delicacy of mutton of the South Down; and also to combine in the same fleeces the weight and length of the Cotswold, with the thickness and softness of the Merino. My success has been so great, and the sale and diffusion of them has been so wide, that I am gratified to be able to give, through the popular Report of the Agricultural Department, the following history of the improvement:

In the beginning about thirty ewes were selected from a flock of unimproved common sheep, and they were bred to a very large and fine Saxony or Merino ram, the object being to give, in the offspring, more thickness to the fleece and more fineness to the fibre of the wool. This step was thought advisable before uniting the coarse fleeces of the native sheep with the coarse and still more open fleeces of the large imported varieties, and the effect was satisfactory. The ewe lambs of this cross were bred on the first of October, after they were one year old, to an imported Bakewell buck, of large, full, round carcass, and a heavy fleece of long wool. The ewe lambs of this latter cross were also, in due time, bred to an imported South Down buck, of large size and high form, the object now being to infuse into the progeny that active, sprightly, and thrifty disposition, and highly flavored and beautifully marbled mutton for which the South Downs are so justly celebrated This object was also successfully obtained. The wethers of this cross were the delight of the epicure, while the value of the fleece was not diminished, as much being gained by increasing the number of fibres to the square inch as was lost in the length of them.

The next cross was made by a ram which possessed, in combination, many of the good qualities which it was desired to perpetuate in the flock. He was three-fourths Cotswold, and one-fourth South Down—a large, hardy, active sheep, with a thick and heavy fleece, and his progeny possessed the same qualities in an eminent degree. The two next crosses were made by pure-blood Cotswolds; and the next by a very fine full-blood Oxfordshire ram, of remarkable softness and silkiness of fleece. They were all animals with short necks, round barrels, broad backs, and full briskets. They added to the flock still more weight of carcass and fleece; while the texture of the latter and the delicate flavor of the former were not perceptibly impaired, and therefore, in the next fall—of 1853—the flock was divided between two fine full-blood Cotswolds.

Every one of these crosses was perceptible in the flock, (blended, but still manifest,) in the character and habits, as well as in the carcass and in the fleece; but in some a particular cross predominated, which was naturally to be expected, on account of the recentness of the improvement. In order to obliterate these discrepancies, and to produce complete uniformity in the flock, it was bred, in 1854, to five select rams of my own breeding. Two of these, two years old, and a grown ewe appear in the accompanying engraving. The progeny showed a reasonable accomplishment of the object; and, though there was some variation in their carcasses and fleeces, still they were in all respects beautiful and valuable animals of their kind.

In the fall of 1855, in order to carry out the same design, I tried chiefly to a mixed ram, whose pedigree showed Cotswold, Oxfordshire, Teeswater, and South Down blood. He was a highly formed and finely finished sheep, of large size and a thick fleece, of medium length and fineness of fibre, and his lambs possessed great beauty and value.

In 1856 I bred chiefly to a large and fine Cotswold, and in 1857 to him and to a ram of mixed blood, the ewes being so selected and bred as to produce a more complete uniformity in the progeny—those having a predominance of South Down and Merino being bred to the Cotswold, and those having a predominance of Cotswold qualities being bred to the mixed-blood ram. In 1858

two large and fine rams of my own breeding were used in the same manner, and for the same objects chiefly, viz: to give uniformity and stability to the flock. A few ewes were also bred, in 1858, to a very fine mixed-blood ram, which was a perfect model of symmetry, and which had taken a premium at the State fair, in Louisville, in that year. In October, 1859, the flock of about one hundred ewes was again selected, and bred with a view to the same object, about one-half being bred to the above premium animal, and the remainder to a fine "Improved Kentucky" sheep, which had a fleece of remarkable length, fineness of fibre, and was of good size and fine form.

By this time these sheep were as essentially alike and uniform, maintained their identity and imparted their qualities as surely, as sheep of any other breed. They had been exhibited with success at many State and county fairs, and had been sold and sent to almost every State in the west and south, even to California; and all which I could raise from a flock of about one hundred ewes found ready sale at the uniform price of thirty dollars for those one year old and under.

Since 1860 well-selected rams of my own breeding, and those of Leicester and of Cotswold blood, have been used in such manner as to impart some valuable qualities either to the fleece or the carcass, or to the constitution of the progeny; pure Cotswolds, superior in form and size and fleece, being raised in 1865 and 1866.

ADAPTATION TO THE CLIMATE AND SUBSISTENCE OF THE WEST AND SOUTH.

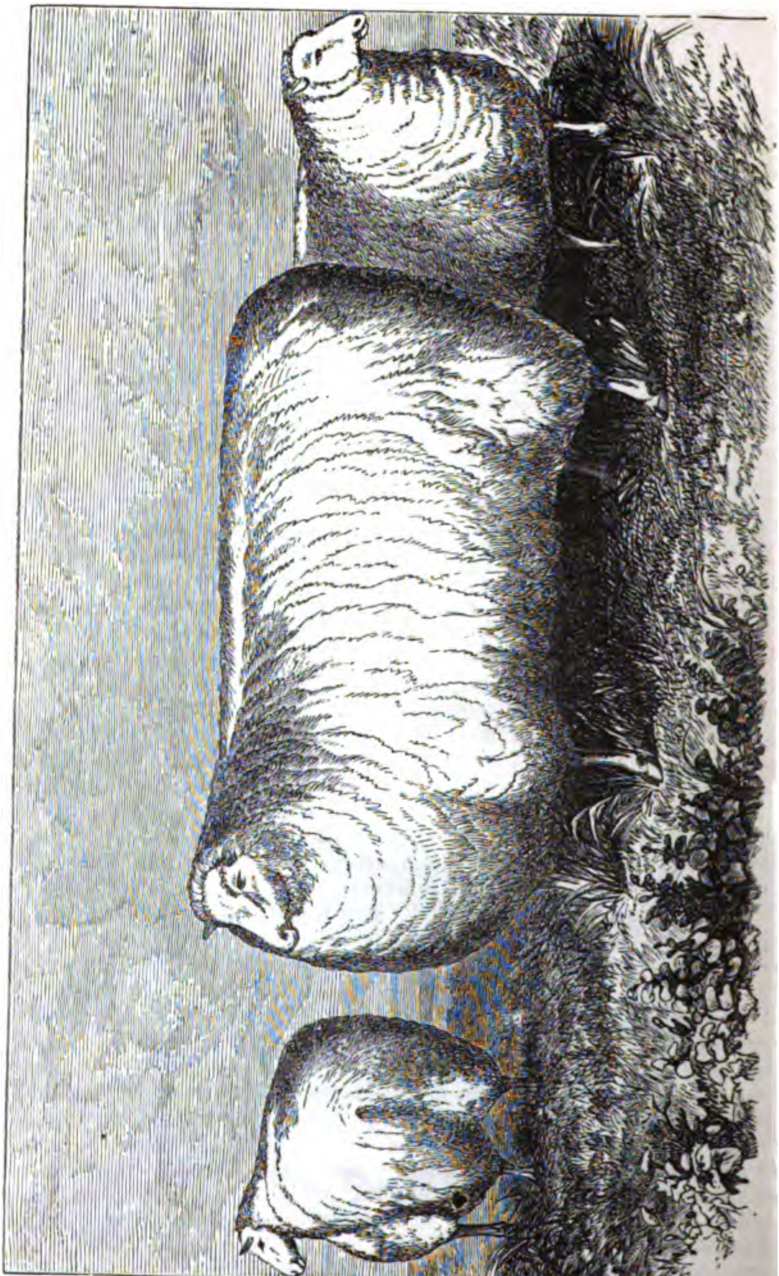
In a country which is comparatively new, and in which stock raising is conducted on an extensive scale, housing in winter is necessarily expensive and troublesome, and it is impracticable except with those animals which are very valuable and very delicate. Hence the necessity that sheep, which are generally regarded as of inferior importance, should be capable of self-protection, as far as is possible. Indeed, it is doubtful whether any breed of sheep which requires housing in winter can become a generally popular and practically successful breed in the west and south. Living at all times in the open air, their subsistence must be of such a character that they can gather it at all times for themselves, or which can be given them at but little expense or trouble. Climate and subsistence are both known to have material influence even on the fleece of the sheep; and so much does the character of the food affect the quality of the wool that the same individual, by a change of food, may be made to produce, at different shearings, wool of widely varied quality and value. Luxuriant and coarse vegetation, grown on limestone soils, is more favorable to the growth of longer and coarser wool; but this tendency may be qualified by judicious crossing, and the growth of fine wool in the west must be sustained by an occasional infusion of fresh blood from the more congenial climates of Andalusia or New England, and thus a superior article of medium wool may be produced.

The "Improved Kentucky" sheep (that is the name by which they have been long and widely known) have always faced the bleakest winters and the hottest and the driest summers without any protection, except that which nature has given them, and yet they have been almost entirely free from all disease, especially from the coughs, which often, in winter, affect sheep of the fine wool breeds; and they have been equally free from the snuffles and foot-rot, which have been so fatal to the long wool breeds. In springs and summers of excessive rains, clothed to the knees and to the ears by a thick, long, and impenetrable fleece, they bid defiance to the wind, rain, and snow, and seem at all times to be comfortable and sprightly. In summer they are changed from pasture to pasture, and they devour almost every green weed. In winter short grass is all they require, and if that cannot be afforded them they will take their corn fodder with the cattle, and thrive well upon it, though at lambing time, like

IMPROVED KENTUCKY SHEEP.

Bred by Robert W. Scott, Frankfort, Ky.

PLATE XXV.



IMPROVED KENTUCKY SHEEP.

Bred by Robert W. Scott, Frankfort, Ky.

other sheep, they require a more succulent diet. My stock sheep have never been fed with grain at any time, and when in winter they have been admitted to a hay stack, they have seemed to prefer the corn fodder.

THEIR THRIFTY AND PROLIFIC CHARACTER.

In the month of August, in each year, any aged, inferior, or declining ewes are taken from the flock; and on being separated from their lambs and put on good grass, they soon make excellent mutton. Only the most healthy, finely-formed, and well-woolled ewes are kept as breeders; and the utmost care has been taken, and no reasonable expense has been spared, to secure rams to breed to them of a similar character, and which would impart some superior qualities to the flock; and no ram has ever been used with any, even the slightest, taint of disease upon him. In this manner, and by frequent crosses with animals which were not even remotely related to each other, (except in the cases and for the purposes above stated,) and also by crossing with rams of different breeds, without making violent crosses, a degree of health and vigor has been infused into this breed, which, I feel assured, is not surpassed, if indeed it is equalled, in any other. So great is their tendency to take on flesh and fat, that ewes which lose their lambs not unfrequently become, on grass alone, too fat to breed; and in several instances I have seen fully three inches of fat on the ribs, after being dressed for mutton, though fed on grass only.

As to their prolific character, native ewes, under favorable circumstances, very frequently, if not most commonly, have twins, and being good nurses, generally raise them well. Notwithstanding the accidents to which they are liable, in the absence of a regular shepherd, and despite the rigors of winter endured without shelter, I have often, when the flock was smaller than at present, raised one-third more lambs than there were ewes, and have rarely failed to raise as many lambs as ewes even under unfavorable circumstances.

As it is not desirable, for many reasons, that sheep should have the size of bullocks, other valuable qualities have not been sacrificed to obtain a large carcass alone. Perhaps they are now fully as large as is compatible with that activity of habit which is indispensable to a breed which shall come into general use in the west and south. Larger and less active animals will always be more liable to the sheep-rot and depredations of dogs, their flesh will be less captivating both to the eye and to the palate, and the animals will be less capable of roaming in quest of food over large pastures and prairies.

None of these sheep have ever been fully fatted, and their weights carefully noted, within my knowledge; but a few years since, I sold sixteen wethers of this breed to a sheep-dealer and farmer, at fifteen dollars per head, and he wrote me: "I sold them at $25 per head, and the person I sold them to did well with them. They took the premium over a fine lot of Cotswold wethers. I consider them better than the Cotswold for mutton and wool, and think they feed more kindly than any sheep I ever saw. They were pronounced, by all, the best sheep in the market." I extract from my sheep register the following weights of some of them, taken in the month of August: A yearling ram, 174 pounds; a two-year-old ram, never shorn, 224 pounds; a grown ewe, 162 pounds; a ewe lamb, 114 pounds; all weighed off of grass, without extra keeping of any kind.

The engraving represents a two-year-old ewe, and a ram and ewe about nine months old. They were driven from the snow-covered pastures, with only grass and fodder as their feed, and weighed as follows: Two-year-old ewe, 188 pounds; ram lamb, 108 pounds; ewe lamb, 106 pounds; each about nine months old.

WEIGHT AND CHARACTER OF THEIR FLEECES.

The fleeces of these sheep vary from eight to fifteen pounds, the whole flock of over one hundred breeding ewes having averaged over eight pounds of merchantable wool, free from burs, tags, &c.; and though not washed on the sheep's back, still clean enough for domestic manufacture. Though the fleeces of these sheep (like those of all other breeds) are not perfectly uniform as to length, thickness, and fineness of fibre, still there is a general uniformity, and the diversity is of no practical disadvantage. Their wool is longer than that of any sheep, except those of the Cotswold family, and is equal in length to that of many individuals of that family, while it greatly excels the wool of the Cotswold in fineness and softness of fibre, and in the number of fibres to the square inch. In some individuals it is wavy or curly, but it is never harsh or wiry. Except the face and the legs below the knees, the whole body is covered with a close and compact fleece, which, when full-grown, leaves no open line on the back, as with the Cotswold; but gives a perfect protection to the sheep, and causes them to present a smooth, handsome, and portly appearance. Their fleeces have enough of grease and gum to preserve the softness and vitality of the fibres, even to their ends, but not so much as to give the sheep a dark and dirty appearance. Their wool receives domestic dyes without any washing whatever, is easily cleaned on the sheep's back, and when it is washed in soft water, with soap, it readily becomes very white, receives chemical dyes, and preserves its lustre perfectly. It has generally commanded from three to five cents per pound more than any other wool, in the markets of the vicinity; and I desire to refer to the opinions of several extensive and intelligent manufacturers who have bought it frequently. Mr. L. C. Stedman, of Georgetown, says: "As regards the wool of your sheep, I think very highly of it, being strong and well adapted to our use for domestic purposes; cards and spins well, and makes a good, strong fabric." Mr. J. W. Martin, of Midway, says: "It is in all respects superior wool, and peculiarly adapted to the manufacture of jeans and linseys, and we have paid more per pound for it than for any other wool." Mr. S. L. Brownell (an extensive and experienced manufacturer of Louisville) says: "I noticed particularly its working qualities, and believe that no cross of wool could be effected that would improve its working character. It seems to have a length, strength, and texture, and at the same time firmness, fineness, and softness of staple, which render it peculiarly adapted to southern and western manufacture and wear. Your sheep will produce yearly eight pounds."

Mr. Joseph Gorbut, of Woodford county, says: "I can and do with pleasure say that we prefer the wool of your 'Improved Kentucky' sheep to that of any other we have ever used. When we take into consideration the fineness of the texture, the length and evenness of the staple, the weight of the fleece, its clearness of gum, (losing less in scouring than any other of any kind,) we can say that we prefer the wool purchased of you to any other we use; and in consequence have for years recommended our customers to supply themselves with your 'Improved Kentucky' sheep."

FACTS AND OPINIONS CONCERNING THE "IMPROVED KENTUCKY" SHEEP, FROM INTELLIGENT AND PROMINENT PERSONS.

Contemplating a publication concerning these sheep, and knowing that the best test of their merits was the practical experience of those to whom I had sold them during many years, I addressed a letter to a number of the most experienced, prominent, and intelligent purchasers of them, requesting a brief and candid statement of their opinions, and their success with them; and I enclose, in their own language, extracts from replies which have been received up to the present time, all of which, I am thankful to be able to say, are quite favorable. Their full address is given, so as to serve others for future reference.

Mr. William L. French, Loutre, Audrain county, Missouri, says: "I have been breeding them for a number of years, and consider them *the* sheep for this part of the country. Their size, weight, and quality of fleece, early maturity, thriftiness, &c., put them ahead, in my opinion, of any other breed. I have crossed them with the common sheep, the Cotswold, and the South Down. The cross on the common ewes was remarkable; a great many of the lambs look as though they might be full blood. The cross on the Cotswolds and South Downs improved the produce of the former by earlier maturity, and by thickness, weight, and fineness of fleece, and of the latter by increased size, and weight of fleece. I have always found ready sale for my lambs at good prices."

From Mr. R. H. Brackin, of Smyrna, Tennessee: "It gives me pleasure to add my testimony as to the superiority of your 'Improved Kentucky' sheep. The lot which I purchased of you did well. I was not able to supply the demand for ram lambs, at twenty-five dollars per head, all of which gave good satisfaction. I raised from one of the ewes two lambs which weighed (at five months old) 105 and 111 pounds gross, and clipped 5½ and 6 pounds of wool; they brought me $50. The mother, when I sold the lambs, weighed one hundred and seventy-five pounds. Another lamb, at six months old, weighed 122 pounds, clipped 6 pounds, and brought me $25. I have had in my flock the pure New Oxfordshire, the three-fourths Cotswold, and the 'Improved Kentucky,' and, of course, had an opportunity of observing their adaptation to our climate, and their fattening quality, &c. The Kentuckies, in my opinion, stand at the head of the list."

From Mr. J. D. Reinhardt, of Lamar, Mississippi: "As regards the sheep which you sent me of your 'Improved Kentucky' breed, after close observation and comparison with other breeds which have claims upon the public, I can safely say that yours are the best for this climate, and our short pastures. They yield more than twice as much wool; are very hardy, and quite as prolific as the native. They are better suited to our climate than the larger breeds of sheep, on account of their easy keep; and their wool is better suited to our wants than the coarser wool. My sheep yielded fleeces of eleven and twelve pounds at one year old."

From Mr. E. Carlin, of Franklin, Louisiana: "They were very prolific, perfectly healthy at all times, and in fine order with no other care but the grazing of our common pastures. I think they are more suitable and better adapted to this climate, and to our pastures, than any other breed."

The following is from Mr. H. H. Rutherford, of Hardinsburg, Indiana, February 2, 1867: "The fleece of a two-year-old ram weighed eleven pounds, shorn in February, and the sheep weighed one hundred and ninety-three pounds after being shorn and having been wintered as stock sheep. They were well liked by everybody, and sold readily."

The following is from Mrs. Ellen Tznaga, an intelligent and enterprising lady planter, of Water Proof, Louisiana, March, 1867: "The sheep you sent me (some years since) were a splendid breed, and have done very well. The wool is particularly fine, for large sheep, and the mutton excellent."

The following is from Mr. W. F. Gray, of Nashville, Tennessee, January 31, 1867: "So far as my observation goes I most emphatically and unhesitatingly assert that the sheep which I purchased of you are unsurpassed by any in this or any other section, both for their wool and mutton qualities. Those which I have are the admiration of all who see them. They seem to keep fat on less than any other breed of sheep which I ever owned."

Mr. G. W. Humphreys, of Port Gibson, Mississippi, February, 1867, says: "Thy will keep fat on less pasture than any sheep I know, and their wool is of superior quality."

The following is from Mr. R. C. Watson, an enterprising farmer, and a woollen manufacturer, of Oregon, Holt county, Missouri, February, 1867: "The wool

of the Kentucky sheep is well adapted to the manufacture of satinet, jeans, linsey, &c. I consider the Kentucky sheep the best breed for all practical purposes which our farmers can raise."

Mr. Thomas Hardeman, of Grenada, Carroll county, Mississippi, January, 1867, writes as follows: "The lambs prove to be entirely healthy and hardy, which has not been the case with the other long-wool varieties which have come under my observation. The two full-blood ewes which I have raised from those which I obtained of you, show the entire characteristics of their dams, and the half-blood lambs which I raised from them (the rams) show very plainly the impress of the parent stock, which, with their hardiness, makes them a very valuable practical breed of sheep."

I offer for publication one letter only from Kentucky, (as their reputation is well established in this State,) from Mr. Thomas Steele, of Versailles, Woodford county, whose father, Judge William Steele, several years since, purchased ten ewes and one buck of me; he claims that "their wool is heavier, finer, and longer, and the sheep are larger and finer looking, than any others I have seen."

Mr. H. O. Colomb, of St. James parish, Louisiana, "regards the breed as the finest ever introduced there."

The following is from Mr. L. W. H. Wright, an intelligent and enterprising practical and amateur farmer and stock raiser, near St. Louis, Missouri: "My opinion in regard to the 'Improved Kentucky' sheep is such as will place the stock upon my farm as a permanent institution. As for mutton, in my estimation, they are equal to the South Down; and for wool, and fine form and size, they excel all others of their grade of wool. They are remarkably healthy and active, and stand as hard weather as any kind of sheep, if not better, as their splendid fleeces are a great protection. When in full fleece they are worthy of the notice of an artist. All of my ewes, bought of you, had twins last year, but one; and that is a great advantage they possess over all others."

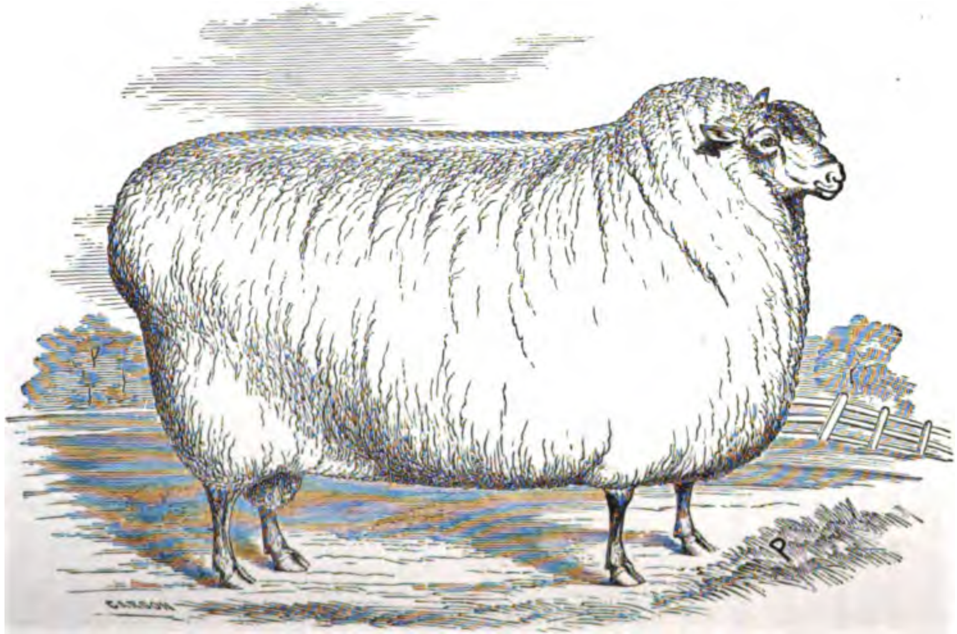
Letters similar in character might be almost indefinitely multiplied, but these will suffice to place this new variety of sheep in a plain and practical view before the country.

My flock, at present, includes about two hundred females, and about fifty yearling males. Samples of the wool of the present flock have been placed on exhibition at the Agricultural Department at Washington.

THE RAM GOLDEN FLEECE.

THE "Maple Shade" flock of Cotswold sheep, imported and owned by Mr. John D. Wing, Maple Shade, Washington, Dutchess county, New York, consists of selected animals from the best flocks of thorough-bred sheep in England, many of them being secured by Mr. Wing personally while in England. They are strictly pure, without a cross, and every sheep has a reliable pedigree. Most of them were bred by William Lane, esq., of Broadfield, his name standing at the head of breeders in the Cotswold hills. Robert Garne, esq., of Aldsworth, is largely and favorably represented, as also William Hewer, esq., of North Leach, and George Fletcher, esq., of Andoversford, both known as very careful breeders.

These sheep are known for their heavy and valuable fleece, their great mutton properties, and strong constitution. The wool is very long, with bright lustre, known as combing wool in our markets, being the most desirable and highest priced of any. It averages over twelve inches in length, sometimes as long as



COTSWOLD RAM "GOLDEN FLEECE.

Property of John D. Wing, Maple Shade, Duchess County, New York. (See page 340.)

eighteen inches, and the fleeces weigh from ten to fifteen pounds each, some rams' fleeces as high as sixteen to eighteen pounds. Mr. Wing says his flock averages twelve pounds. They are highly valued for mutton. When fattened, they grow to a very large weight, in some cases attaining three hundred and fifty pounds. They are very hardy, capable of enduring much exposure. The sheep from this flock have carried off the highest honors; and the prize ram, Golden Fleece, (whose picture is given herewith,) was shown at the Auburn fair of the New York State Sheep Breeders' and Wool Growers' Association, in May, 1867, when he took the first prize in his class and also the sweepstakes prize. He sheared on this occasion nineteen pounds four and a half ounces of wool. He was bred by William Lane, esq., of Broadfield, sired by Cotswold King, (sold for 230 guineas, and claimed to be the highest-priced Cotswold sheep ever sold,) and his dam was winner of the prize of the Royal Agricultural Society of England. He is the stock ram used in the flock at present, and his lambs are very promising. Mr. Wing's farm, Maple Shade, is at Washington, Dutchess county, New York, about six miles from Dover Plains, on Harlem railroad, and sixteen miles from Poughkeepsie, on the Hudson River railroad.

WHY AND WHERE MUTTON SHEEP ARE PROFITABLE.

BY J. R. DODGE, DEPARTMENT OF AGRICULTURE.

WHY?

PROFIT is the golden beacon which guides the farmer's course. Like other men, he is propelled by the pecuniary motive with the power of a locomotive, and to direct him in a certain course it is only necessary to show that it will prove remunerative. Is it profitable to keep sheep? and why?

The great antiquity of the business is presumptive evidence of profit. Shepherds figure in the earliest history. "Abel was a keeper of sheep." Its extension among nations of all degrees of civilization, and its retention in countries the most populous and wealthy, illustrate the universal belief that there is money in it. Hence the soubriquet "golden hoof" has been applied to the sheep, which, by very ancient authority, were declared "the most profitablest cattle" that could be kept.

Why? Because its covering has ever furnished clothing for man, the naked animal, "the biped without feathers," whose wants demand the presence of the woolly quadruped; because its flesh is ever an important item of the food of man, becoming juicier and richer in the domain of high cultivation and epicurean taste; and because its skin even finds protean uses, in the form of covers for books, in parchment for valuable manuscripts, in gloves for delicate hands, and formerly in linings for valuable garments. The caprice and cruelty of fashion have been such that the ewe was often killed, and the well-developed lamb taken from her and destroyed on the supposition that the skin was more beautiful than if obtained after birth. What animal has such resources for a supply of the wants of man—such elements of profit?

It is therefore held to be proven that sheep are profitable, without showing their special adaptation to the economy and success of farm management and systematic improvement. The object of the present investigation is to show why

mutton sheep are profitable—meaning the long and middle wool breeds, (formerly called long, middle, and short wool, in Great Britain,) as distinguished from the fine wool, now mainly represented by the various families of merinoes. This involves a comparison in wool, in flesh, in hardiness, earliness of maturity, prolificacy, and cost of keeping.

It is seen in history that fine-wool breeds, under certain circumstances, either of climate or farm economy, have gradually disappeared, and given place to heavier sheep, with longer wool; and this has happened, not in countries lapsing into barbarism, but improving and becoming more productive; in England, as in the case of Ryelands, distinguished for the fineness of their wool—the Delameres, of Cheshire, with a fleece short and fine—the Shetlands, yielding one and a half to two pounds of soft wool, of which it was said, thirty years ago, that "it is the finest wool which Great Britain can produce, and is used for the better sort of stockings, and for several light and extensive manufactures"—and the "beautiful little sheep of Shirley Forest, not yielding more than eight or nine pounds to the quarter," bearing a delicate fleece. All these have passed away, or have been modified into larger animals, with a heavier fleece of longer and coarser wool—a fleece more useful for many purposes, and in many cases double in value.

Narrowing the comparison of these two great classes of sheep, one popularly supposed to excel in fineness and value of wool, the other in mutton, to the limits of our own country, it is proposed to present a few salient points, and to offer original facts illustrating them, that the question of profit may be weighed without prejudice, and the farmer be enabled to judge whether his circumstances favor a continuance or change of the character of his present flock. Strong prejudices often exist, simply because a flock-master, accustomed to one class, judges the other by the same standard, not recognizing the fact that an entirely different management is requisite—thus holding a breed responsible for an inevitable failure, the result of ignorance of its peculiar qualities and requirements. This is strikingly illustrated in holding the Leicester, which matures in two years, year after year, as is done with the Merino, which matures with half that rapidity, and consequently losing the benefit of the easy fattening and early maturity of the former, qualities that are so highly appreciated in the short-horn breed of cattle. The farmers of the blue-grass region of Kentucky recognize the analogy, and are consistent in its application, generally tolerating no cattle but Durham, and no sheep but South Downs, Cotswolds, or "Scott's Kentucky."

WEIGHT OF FLEECES.

There is a tendency to misconception in the public mind, of the average weight of fleeces, since the advent of the era of grease. While the number of these fancy weights is few in proportion to the mass, they have exercised a manifest influence in increasing the weight of grade fleeces in all of the northern States. The census exhibit for 1840, which must have been deficient in the item of wool, was equivalent to 1.84 pound per head; in 1850, 2.42 pounds; in 1860, 2.73. In view of the low average in the south, in New Mexico, and on the Pacific coast, prior to the introduction of heavy-fleeced Merinoes, the latter figure was not far from the true average at that date. At the present date it cannot be more than 3.25 pounds for the whole country, though Vermont, New York, and Ohio would average more. At least three-fourths of our sheep are Merinoes and their grades. In Maryland and Virginia, low grades of Cotswold, Leicester, South Downs, and Tunis sheep, (or mixtures of several of these breeds,) predominate: and in the south generally, and in the southern Territories, a "native" or mongrel race exists, either with coarse wool or wiry hair, as little like the soft, long fibre of the improved English breeds, as its scanty showing on the scales likens it to the ponderous bulk sheared from the latest style of Cotswold. Many have formed

their idea of the weight of the mutton-sheep fleece from such scrubs, the offspring of carelessness and neglect, with only here and there a touch of such quality of blood as the comparative improvements in breeding in the past had rendered possible; and when improved, at all, quite as often with an infusion of Merino blood.

Those who decry long wool should remember that improvement has been quite as rife and rapid, during the past generation, in those breeds as in the pampered Merino. If a fair comparison be made, let it be between immense numbers, and not between isolated individuals. The sheep of this country, mainly of Merino blood, average fleeces of 3.25 pounds; those of Great Britain, mostly long and middle wools, average fleeces of 4.5 pounds, according to Wilson, while others make a higher estimate. After allowing for extra weight of the latter, it will readily be seen that the boasted superiority of the Merino, in the proportion of wool to live weight of the animal, is more mythical than real. Whole flocks of improved Cotswolds yield eight pounds each, and the tendency of recent English improvements is to still heavier weights. Large fleeces of all the breeds are occasionally noted in this country as well as in England. A few cases will suffice as evidence. At the Auburn, New York, fair, May 10, 1867, the Cotswold ram "Golden Fleece," two years old, owned by Mr. John D. Wing, sheared nineteen pounds four and a half ounces, 381 days from the previous shearing. The growth of twelve months would therefore be eighteen pounds five and a half ounces. The length of the wool was nine and a quarter inches. A ram teg of the same flock sheared eighteen pounds nine ounces; fourteen inches in length.

Other specimens, forwarded to Dr. Randall, to be used by the committee authorized by the Secretary of the Treasury for selection of the tariff samples, represent fleeces scarcely less in weight. One fleece of a ram teg, thirteen months old, bred by L. Converse, Bucyrus, Ohio, length ten and three-quarter inches, weighed ten and a half pounds. A fleece of a Lincoln ram, two years old, owned by Hon. Samuel Campbell and R. Gibbon, New York Mills, Oneida county, New York, weighed seventeen and three-quarter pounds. Another washed fleece, from the same flock, fifteen and three-quarter pounds; last year eighteen pounds. The wool of these fleeces was ten and a half inches in length, of the kind known as luster wool, in great demand for ladies' fabrics, and bringing high prices. Beautiful samples of this wool, very lustrous and fine, and about eleven inches long, are before me as I write, with a note from the owners claiming 11 pounds 5 ounces as the average weight of their ewe's fleeces, and 15¾ pounds and 17¾ pounds respectively for fleeces of their rams. One ram weighs 310 pounds; ewes, in good order, weigh 200 pounds. All have done well since their importation. A Lincoln ewe is reported in England weighing 364 pounds, with a girth of 6 feet, yielding 67 pounds of mutton per quarter, after producing 75 pounds of wool and five lambs in five years.

It is a misnomer to call this Lincoln wool "coarse." The sample above is of gossamer-like delicacy. It is stated that 60 years ago an English maiden (a "spinster,") spun 68,000 yards or 95 miles of thread from a pound of wool from a Lincoln ewe. A Bradford (England,) manufacturer states that a twenty-pound Lincoln fleece, used in an admixture with cotton in the finest "alpaca" fabrics, is sufficient for 12 pieces of 42 yards each, and possibly 16 pieces, or 672 yards in length, one yard wide, worth, at 75 cents per yard, more than $500.

Let such fleeces be cleansed by a manufacturer, in competition with the greasy rams' fleeces, weighing twenty to thirty pounds, and the net result will be about twice the weight of the heavier and dirtier wool. I have known a pound of Cotswold wool to produce as much clean fibre as two pounds fourteen ounces of Merino ram's wool.

"BREEDING TO GREASE."

The mania for grease, which has so prevailed, will work its own cure. Already is the curative process in operation. It is often said, in substance: "I shall breed to grease as long as it pays. I get fifty cents per pound for rams' fleeces, and what do I care if one of twenty pounds only cleanses four pounds, if I receive the $10?" But the assumed profit is a deception. The ram's fleece, taken with the entire clip of the flock, may count at the rate of fifty cents per pound, but a hundred rams' fleeces alone would scarcely be received at half the price. Already manufacturers neglect Vermont wool, and send agents to buy the longer and cleaner grade fleeces of Ohio, paying a higher price for coarser wool, which is modified but partially by the blood of the coveted full-bloods. Should the process go on a few years, till all the wool of the west is tipped with the black gum that has become the principal secretion of an animal formerly yielding mainly a textile fibre, the reluctance of buyers would become positive refusal, except at prices illustrating a far wider difference than now exists in the price of long and fine wool.

There is no commercial value in two-thirds of the weight of these greasy fleeces. The laws of trade are inexorable; and ultimately prices will depend upon intrinsic value, and will bear relation to the relative amounts of scoured wool. This idea of breeders has been an essentially selfish and dishonest one in spirit, though not generally in intention; and in its manifestation rams have been selected not so much to improve the wool of large flocks, as to add two pounds in weight, one of which shall be grease and dirt, under the mistaken belief that, because a few such fleeces in a thousand have not materially depressed their selling price, therefore the reduction of the entire clip to such a standard would have no depressing influence. A few, foreseeing the inevitable result, have said, "I will turn an honest penny by selling grease while it has a marketable value." "All our sharp, shrewd wool-growers prefer the gummy, greasy Merinoes," said a Michigan correspondent; "they shear more pounds of wool (?) and yield the most money per head." As a matter of policy such selfishness is a blunder; as a source of gain it will ultimately prove unprofitable, and in the reaction result in loss; and as a motive of action it is demoralizing. It has proved injurious to the general welfare, by furnishing specious and fallacious comparisons unfavorable to the increase of mutton sheep in sections where they would be preferable to all others, and a great benefit to the agriculture of such localities.

The methods employed for obtaining these prize fleeces illustrate the inherent deception of the business. The following description of the process, by Dr. Randall, is graphic and true:

"The first step to get the heaviest unwashed fleeces is to breed from rams and ewes which have that combination of wool and yolk which weighs most; secondly, to promote the growth of wool and the secretion of yolk to the greatest practicable extent by high keep; and thirdly, to prevent any portion of the yolk from being washed out of the wool by rain or snow, or dried out by strong drying winds. To get a teg's fleece to brag of in the newspapers, he should be dropped early in winter (say January,) receive what grain, &c., he will eat in addition to his dam's milk until weaning—through the summer in addition to good pasturage, through the fall, through the ensuing winter, and up to the time of shearing. He must be carefully watched and tended to see that he is never fed enough to cloy his appetite, but he must be given as much as he will safely bear. If a drop of rain promises to fall, his owner should leave hay or grain to be spoiled in the fields, or if in meeting leave in the middle of the sermon and run his horse home, rather than allow an ounce of yolk to be washed from the fleece. He should be kept near the house for greater convenience in this respect, and if business calls the owner away a few hours, he should strictly charge the women and children to rush out and 'get in the ram' if a sprinkle is threatened. In

winter he should never be let out of the stable, unless led out or kept under the eye of an attendant, for if he lies down on the snow, even, it will subtract some of the precious yolk. As to feed, it should be of the best. The hay should be without dust and as green as a leek. He should be allowed to pick off the fine tops and the nicest leaves, but never should be allowed to exert himself sufficiently to consume any other portion of it. By no means give him light oats or any kind of grain not of the choicest quality. It is said that oil-cake and certain other feeds are great in producing yolk. When shorn, all the 'sweat balls' from the belly, inside the legs, and scrotum, should be carefully put inside the fleece. Use twine freely. A quarter of a pound is not too much, if used judiciously; it can be taken off afterwards if necessary. If you start with a tolerably heavy-wooled and yolky fleece teg, and follow these direction closely, you will be likely, if your teg does not happen to die before shearing, to beat your neighbors all hollow who have lambs come at the ordinary time and treat them in the ordinary way. And the merits of the system are conclusively proved by the fact that you will thus utterly beat sheep worth twice as much as your own, and which would easily beat yours in weight of fleece under the same management. Your teg will shear twice as much unwashed wool as he would do if dropped at the usual time and treated in the common way. You can sell him for from four to six or even ten times as much, especially to new beginners who expect to get rich by ram selling in five years."

HARDINESS.

Much is claimed by fanciers of Merinoes for their hardiness. They are very gregarious and are found in large flocks; but it never is claimed that a flock of ewes bring forth and bring up as large a percentage of lambs as long or middle wool breeds. Returns to this office show an advantage of sixty-seven per cent. in favor of the latter in this respect. It cannot be shown that Merinoes are less liable to disease. Low, in his English "Domesticated Animals," writing of the Spanish Merinoes, says: "The females are the worst nurses of any race of sheep which inhabit Europe. So great is their defect in this respect that in Spain half the lambs are killed in order that the ewes may be enabled to suckle the remainder, it being calculated by the Spanish shepherds that the milk of two ewes is required to bring up one lamb in a proper manner. Abortions are frequent; parturition is difficult; and the ewes are more apt to desert their offspring than any other sheep known to us. In these respects the Merinoes resemble the ancient Aves Molles, of Italy, which were remarkable for the delicacy of their constitution, their voracity, and inferior power of secreting milk. The same causes, it would appear, have produced the same effects. Attention *having been mainly directed in both cases to the production of wool,* the other properties were disregarded, of hardiness and the power of yielding fat and milk." I will not assume that the American Merinoes have not been improved in hardiness, but the evidence of increasing disease, everywhere prevalent, suggests a doubt of the continuance of such improvement at the present time.

The author of the "Practical Shepherd," in a recent newspaper article, admits that "the choice stock rams of the country are proverbially short-lived, and the evil has rapidly increased within the last half a dozen years." He attributes this to the forcing process by which these heavy fleeces are obtained, and admits that "forcing impairs the constitution"—that "high-fed and summer-grained tegs sometimes die off unaccountably in winter"—and doubts "whether fifty per cent. of the high priced rams of the country survive their fourth year." Such an accumulation of the oily secretions of the body on the surface, sealing up the animal in an almost air-tight covering, must clog the natural flow of effete matter through the skin after the fleece becomes full, and have a pernicious effect upon the health of the sheep.

Old sheep have died by thousands; young lambs have perished by hundreds in a single flock; even the vigorous, thrifty teg, neither a puny weakling nor a worn and weary starveling, has sickened and died; the housed and the sheltered have fallen, though not in equal numbers; and while the scantily fed have succumbed to disease, the pampered, full to fatness, have staggered from the hay-rack and grain-trough, to lie down and die. The record of disease in the statistical division of the Department of Agriculture is a long and suggestive one, especially memoranda like the following, relating to whole counties together: "One in every twenty has the foot-rot." "A very destructive disease prevailed among sheep, whereby one-third died; disease not known, but it appears to be something like consumption." "Grub in the head prevails; one flock lost one hundred, others ten to sixty." "Half the lambs lost from cold storms." "Fifteen per cent. lost in wintering." "Heavy losses have resulted from rot; livers light-colored and quite rotten." "Half the lambs were lost." "One man lost one hundred, half his flock; another eighty, others sixty each; in this county 8,000 perished in the cold storm of June last." "Six per cent. loss from rot." "Losses of two hundred to three hundred head are reported." "Two and a half per cent. of our sheep died, attacked with a swelling under the jaw; they moped around four or five days and died." "The rot has prevailed among the sheep; in some cases entire flocks have been destroyed." "Rot has destroyed three-tenths of the sheep." "Two-thirds of the sheep of this county have died with the scab, or from exposure." "Some flocks have lost half from exposure." "In this county the loss must be many thousands." "One farmer lost five hundred of his sheep."

The most eminent breeders of fine Merinoes do not escape loss. Among many others that might be named, Samuel P. Boardman, esq., of Lincoln, Illinois, writes of his "mysterious loss," not of lambs from exposure in storms, but tegs, which "have been fed and handled better than any" of his flock, with two large sheds for shelter, and timothy hay and corn constantly by them—yearlings "in splendid condition." And notwithstanding all this care they were dropping off, during March and April, and even after getting upon fine spring pasture they were dying "two or three per week," up to the last of April. He acknowledges that in central Illinois "men have lost more sheep this spring and during last winter than usual." And Dr. Randall is "convinced that the mortality among tegs has been unusually large throughout the country," and declares that "some of the best flock-masters in New York have met with very severe losses."

An idea of the excessive losses of the past year may be realized from such statements as this, reported from Minnesota: "Sheep are not kept very largely in our county, though there are flocks of 500 to 1,500 head. In two flocks coming under my notice there has been considerable loss. One farmer lost 500, and was so disheartened that he sold the remainder of his flock for $1 50 per head. The disease is new to me; the heads of the sheep swell, and in a day or two they die, eating well nearly to the last."

While it is not pretended that all these sheep were Merinoes, it is undoubtedly true that most of them were of that breed. It is significant, that in this country of the improved Merino, no species of farm stock, with the exception of the hog, has suffered like sheep from disease during the past year, a period characterized by more than usual severity of losses of domestic animals. I am fully satisfied from an examination of current farm statistics of Great Britain, that no such mortality has affected the mutton breeds of that country in the same period.

In this country, the superior healthfulness of the long-wools during the past year has been strikingly exemplified in the reports from Kentucky and Maryland.

PRODUCTION OF MUTTON.

When long wool bore a low price, and fine wool commanded a high rate, it was deemed economy in favorable localities to cultivate mutton sheep, the quantity and quality of the flesh more than compensating for the deficient proceeds of the fibre. Now that the price of the long and soft fleece has reached the value of the finest of the Spanish race, and the quantity is but little less, there is a still more manifest economy in the keeping of the thrifty races; and it is beginning to be seen that what was profitable before, must now be more remunerative.

In the production of meat in the shortest time, and in proportion to cost of keeping, there is no rivalry between the two classes. A statement received from a Vermont breeder, whose Merino lambs sell at $50 each, will not be considered partial to other breeds. He places the average growth of two breeds which he keeps as follows:

	Merinoes.	Leicesters.
First year	50 pounds.	75 pounds.
Second year	20 pounds.	25 pounds.
Third year	10 pounds.	25 pounds.
Weight at three years	80 pounds.	125 pounds.

Here is an increase of 56 per cent. over the growth of the Merino. But the statement is unfair to the Leicesters, which are nearer to maturity at two years than Merinoes are at three. In three years the growth attained is 80 pounds in one case, and in the other 100 pounds in two years—25 per cent. advantage, in addition to the saving of one year's feed, care, and risk. If the mutton breed were as well bred as these Vermont favorites undoubtedly were, the figures representing growth would have been much higher for the second year than for the third; and the superiority of the Leicesters in mutton production, great as it is, would have been still more conspicuous.

The same statement furnishes good evidence upon the vexed question of the comparative cost of keeping. Both flocks were fed liberally, having the same rations, for six months, of corn, oats, carrots, and beets, with 25 per cent. more hay for the Leicesters; their increased estimate for pasturage was 33 per cent. The cost of keeping, excessive in both cases, was $5 40 for Leicesters, and $4 60 for Merinoes, an excess of only 17 per cent. for the former, while its excess in weight of flesh was 56 per cent. for a period of three years, and for the third year of growth 150 per cent. The wool of the Leicesters, in this case, produced 4 per cent. more money than that of the Merinoes, which would have yielded a far smaller aggregate of profit but for the temporary and exceptional advantage of fancy prices for breeding purposes.

I have noticed a record of the weight of five Cotswold wethers, fed for the New York market, as follows: 217, 222, 204, 223, 243. Five other wethers, twenty-one months old, averaged 188 pounds. These weights are not extraordinary, but are easily attained at an early age.

If a Merino wether, in good condition, killed at four years old, weighing one hundred pounds, will supply fifteen pounds per quarter, or sixty pounds of mutton in all, and a Shropshire or Oxford Down, at two years old, will furnish one hundred and twenty pounds of meat (twice the quantity in half the time,) equally mature and of better quality, is it not plain that the amount of food consumed, allowing the consumption to be proportionate to weight, is the same in both cases? But the consumption of feed is evidently not in proportion to weight. As between individuals of the same breed, or between some of the best families of different mutton breeds, the maxim may be approximately correct; but no one in his senses can believe that the assimilating power of slowly-maturing animals equals that of the rapidly improving kinds. While the *food* is the same, in the case cited,

the *product* of the long wool is double. Nor is this the only advantage. For every thousand dollars of the value of a flock, the interest upon the investment for two years is saved, or $120 at six per cent., with the care and risk of health and life for that period.

Another source of meat production is found in the superior prolificacy of mutton sheep, and rapidity of growth in the lambs. Lambs at three or four months are easily made to weigh fifty pounds dressed, while Merino lambs do well to reach twenty-five, and the larger lamb also commands the better price and sells for as much as the carcass of a Merino sheep weighing sixteen pounds to the quarter. Here the element of time, in its power to produce extra profits by quick returns, is more signally illustrated than in the comparison of the mature mutton of the two races. And while the quality of the heavier lamb is better, no man who has given both kinds fair treatment will pretend that it costs as much, pound for pound, as the other. This is a marked advantage; but there is another which should not be overlooked. A producer of early lambs may wish to feed ninety in a single spring. If he selects Merino dams he must have a full hundred; if South Downs, Oxford Downs, or the improved Cotswolds, he will accomplish the same result with sixty, saving the cost, care, and keeping of the other forty. If they eat more, they are maturing more flesh for the butcher, which pays for itself, and must not be placed on the debtor side of the lamb's account. This business of producing early lambs of such quality as to command the highest possible price paid for mutton is one that pays heavily those engaged in it, and which will command the attention and enrich the coffers of many others in the immediate future. Mr. W. E. Haxtun, of Dutchess county, New York, reports the weight of one of his lambs at 44 pounds when 54 days old; another 45 pounds at the same age; one 44 pounds at 52 days; and one 52 pounds at 51 days old. A ewe lamb weighed 14 pounds at birth, 26 pounds at 14 days old, 36 pounds at 26 days, 45 pounds at 40 days, 56 pounds at 49 days, and 63 pounds at 59 days. The Canada Farmer has a record of a Leicester lamb which weighed 17 pounds at 4 days old, and 34 pounds at 30 days; and notices four ewes that have had 39 lambs in four successive years, respectively as follows: 7 in 1864, 11 in 1865, 9 in 1866, and 12 in 1867.

At the present writing the price of lamb as reported by the New York market is 16 to 20 cents per pound; mutton is quoted at 10 to 12 cents; beef sides, 11 to 14 cents. This is a fair illustration of the comparative price of lamb.

The same superiority always exists in England. As I write, the quotations in "Newgate and Leadenhall" market range as follows: Beef, from 3s. 2d. to 4s. 6d. per eight pounds; veal, 4s. to 5s.; mutton, from 3s. 6d. to 4s. 10d.; lamb, 5s. to 5s. 8d. In the Metropolitan market, at the same time, lamb was 5s. 8d. to 6s. 8d. per eight pounds. This is above 20 cents per pound.

Few people in this country are acquainted with the management, the uses, and the economy of mutton-sheep breeding. Obtaining specimens, they are treated as "natives" or Merinoes, kept year after year till signs of old age appear, sheared annually for their wool, but rendering no advantage from their distinguishing peculiarities, early maturity, and tendency to fatten. They are often fed irregularly or scantily, a course fatal to the highest thrift or profit, and though they may endure the privation without suffering, they cannot be fattening economically. If fed abundantly they will produce more meat from a ton of hay or roots than any fine wools possibly can. There is no more doubt of this than that short-horn cattle, in the hands of good feeders, will yield more beef than more slowly maturing breeds. Formed upon the same principles of breeding, and bred with the same aim, there is no doubt that the same result has been attained. They should be managed, then, at all times, with this point in view.

WHERE?

Having illustrated some points in the comparison of the two great classes, showing why mutton-sheep are found to be profitable, the question is naturally connected with the inquiry *where* they are likely to prove most profitable. In truth, it is from ignoring the latter query that people's ideas are in such confusion on the main question at issue.

It is freely admitted that it turns measurably upon population, climate, herbage, and the condition of agriculture.

In mountainous districts, far from the centres of population, wool is the prime object, and fine wool is preferable in such localities, not only because the improved mutton-sheep require abundant and regular feed, but the mountain grasses are more conducive to fineness of fibre than the coarser and heavier grasses of the lowlands. The fine wool sheep of the Alleghanian slope of western Pennsylvania, when transferred to the prairies of the Mississippi, will increase in size and in quantity of fleece, but its excessive fineness will not be maintained. There are glades and mountain valleys in Virginia, and further south, where the herbage is sufficiently succulent and abundant to make mutton and wool production equally profitable with fine wool-growing. In Virginia an additional advantage is found in close proximity to the large cities, Washington, Baltimore, and Philadelphia; and New York is within a day's travel.

The country west of the Mississippi, including portions of the great plains and the basins of the Rocky mountains, are generally best adapted to fine wool. The requirements of the future may make mutton breeds profitable in the most fertile sections, near flourishing towns, and probably they would do well amidst the luxurious herbage of the parks of Colorado, and find a good market among the thousands of miners and others who will throng that region. In view of the unthrifty condition of agriculture in the south, careless habits of feeding prevalent, and the sparseness of the population, Merinoes or their grades will generally be preferred there, though Cotswolds and South Downs are favorites with many, and will gradually be interspersed among appreciating and liberal farmers, and will increase with the improvement of agriculture.

It is in the populous section of the northern Atlantic seaboard that mutton sheep, in this country, are most profitable. Near to cities they are driving fine wools from the farms, and asserting their natural supremacy as the sheep for highly cultivated and expensive lands. The unenterprising and unthrifty farmer, even here, had better hold to his Merinoes; he will only sacrifice a little wool by his carelessness, instead of both wool and mutton. The great cities, containing an aggregate of millions of people, must have mutton, and many *will* have a better quality than Merino mutton. The supply of this want from great distances involves an immense sacrifice for transportation, care, and brokerage, and a great deterioration in quality. It must be met mainly by farmers of the Atlantic slope. The objections to Merinoes in Great Britain are not that they do not thrive in that climate, nor that the wool deteriorates, though its fineness is decreased under the generous regimen of that country, as it is in the case of the thorough-bred American Merinoes from a similar cause, but that they are not equal to their own improved breeds in economical importance. "Is it not better," British feeders say, "that we should trust to commerce for the supplies of a commodity which can be raised more cheaply than at home, and devote our sheep especially to the production of that food which no other country can supply us?"

Merino varieties predominate upon the continent of Europe, except in the Netherlands, and in very populous and highly cultivated sections. Where land and labor are cheap they prevail, but yield to mutton production when prices increase, and high farming produces heavy crops of grass, grain, and roots.

A review of original correspondence upon this point will develop facts in illustration of these views. Reference to these facts, which relate to a growing

preference for mutton sheep in improved and populous sections, and also include incidental points of comparison with other breeds, will show that some farmers in the west, and a few in the south, are testing the comparative profits of wool-growing and combined wool and mutton production, and, for themselves, are satisfied with those animals that are always the sign and the concomitant of good farming.

In the vicinity of Boston few sheep of any breed are kept; but the preference is given, by most farmers of the State of Massachusetts, to the long and middle wool sheep. Importations have frequently been made of the several Down families, Cotswolds, Texel, and other breeds. This tendency is evidently increasing, and will ultimately result in the complete supremacy of the mutton tribes. Correspondents in different localities unite in their views upon this point.

In Franklin county, a correspondent states, that the long-wool sheep are more abundant than formerly, especially the South Down. For the past five years the wool has brought more per head than the Merino. The cost of keeping is about one-eighth more for the coarse than for the fine, but the high price obtained for early lambs has more than balanced the difference in keeping.

In Newport county, Rhode Island, a correspondent intimates his belief that there are not ten pure Merinoes in the county, where they prevailed thirty years ago. He represents Cotswolds as increasing, Leicesters decreasing, while South Downs are regarded with the greatest favor, particularly for raising early lambs for the shambles. Shropshire and Oxford Downs are attracting some notice. He intimates the cost of keeping of the different breeds, in proportion to the live weight of the sheep, and the average weight of wool at four pounds per fleece.

In Litchfield county, Connecticut, upon authority of T. S. Gold, the proportion of South Downs and Cotswolds has increased, and the recently improved sheep yield fifty per cent. more wool than the old stock, and of superior quality.

In the vicinity of New York the production of mutton asserts its superiority to wool-growing in point of profit. The statement that "no farmers in the county keep sheep for their wool," as in Westchester, New York, is approximately true of all counties in proximity to principal cities. Thus, in Dutchess county, New York, as might be expected, "the greater portion of the sheep are kept for mutton." In Ulster, a cross between Cotswolds and South Downs prevails. "There are no Merinoes kept in the county; they have been tried at different times and found unprofitable." Away from the city as far as Schoharie county, "very few Merinoes are owned," the principal flocks being Cotswold, South Down, and Leicester, and grades of those breeds "which winter better and have less disease" than Merinoes, shear from five to six pounds per head, and secure high prices for fattening purposes. In Albany county, a well-known breeder of long wools, Mr. Jurian Winne, in comparison of notes with a friend who has long been a breeder of fine wools, has found the former to be the more profitable in that locality. In western New York there is a growing regard for mutton sheep, which are more abundant than formerly.

Opinions are now freely expressed like the following from Seneca county: "Cotswolds and South Downs are more abundant than formerly; they are beginning to be sought after for wool and mutton combined. The cost of keeping is no more in proportion to the weight of carcass. They live on coarser feed, the lambs are hardier, more easily raised, and mature much sooner."

A gentleman in Schenectady county, New York, furnishes an illustration of the comparative fattening capacity of fine and coarse wool sheep. In December, 1865, he purchased one hundred and fifty Merino wethers, averaging 108 pounds each, and fed them $2\frac{1}{2}$ bushels whole peas each. He sold them ninety-two days from the time of purchase, weighing 114 pounds each. At the same time he bought one hundred and fifty South Downs and Cotswolds, wethers and ewes, averaging 130 pounds, gave them the same feed and treatment for the same length of time, when they weighed 145 pounds each. Thus the gain of the long wools

was one hundred and fifty per cent. more than that of the Merinoes. In December, 1866, he purchased in Canada five hundred Leicesters, wethers and ewes, averaging 125 pounds each, and fed them shelled corn and oil cake, at the same cost as for the peas of the previous year. At the end of ninety days they averaged 148 pounds. In each case cut broom-corn stalks were supplied for food and bedding. All were alike healthy.

The same state of facts exists in the vicinity of Philadelphia, where sheep are mainly kept for mutton; and summer purchases for feeding are of the mutton varieties as far as practicable. This is especially the case in Gloucester county, New Jersey, below Philadelphia, and in the rich and highly improved district of Lancaster, and adjoining counties.

Leicesters of greater or less purity are prevalent in Montgomery county, Pennsylvania, of medium size and light bone, taking on flesh and fat with great readiness, and weighing about one hundred pounds dressed. It is claimed that they require less feed than other breeds of the same size, and they are accordingly held in high esteem. Their wool is long and fine, and finds a good market.

In Butler county, Pennsylvania, the fleeces of coarse-woolled sheep are reported a pound or two heavier than Merinoes. The average for Cotswold fleeces is placed at eight pounds in Franklin county, Pennsylvania.

In Luzerne county, Pennsylvania, it is said: "The Cotswolds, Leicesters, and South Downs, with our natives, are the principal sheep raised here. Mutton being in great demand, at high prices, they are the most profitable breeds our farmers can raise. Our market is at home, and the prices higher than those of New York or Philadelphia. We have no pure Merinoes; they have been tried, but not proving as profitable as mutton sheep, have been discarded."

A correspondent in Vinton county, Ohio, refers to his flock, mostly Merinoes, with a few grade South Downs interspersed, all fed together, and testifies to the far superior condition of the Downs. His fine-wools averaged 3 pounds 14½ ounces per fleece, and his coarse-wools 4 pounds 2 ounces. In Medina county, of the same State, where they are not numerous, "small farmers are becoming more in favor of coarse-woolled sheep." It is conceded in that locality that the "cost of keeping is a little more than that of Merinoes; the weight of fleece is not much greater, but lambs are healthier and sell for more to the butcher." It is further stated of the Merino flocks of this county that "sheep came out of winter quarters poorly, *especially where the flocks were large*. In this township one man lost more than a hundred, or half his flock; another eighty; two others sixty or more each; and so on down to ten or less." It is but fair to say that these heavy losses occurred in flocks that suffered most in the great storm of June, 1866, when 535 perished in the township in question, and 7,000 to 8,000 in the county, and that the survivors were doubtless debilitated by the exposure.

Testimony also comes from Clermont county, Ohio, that Cotswolds, Leicesters, and South Downs are taking the place of the Merinoes;" that they do better there, and appear to be more healthy; that they do not require as close attention, and are more profitable.

There are occasional expressions of this preference for mutton breeds coming even from the prairies, where their popular competitors have enjoyed singular and extravagant favor. For instance, in Williamson county, Illinois, it is said that "Cotswolds and other mutton breeds are found more profitable than Merinoes. The Cotswolds yield as much wool, which is better adapted for working by the machinery of this part of the country;" and, strange to say, in the border region of Minnesota, Nicollet county, while it is supposed that "Merinoes furnish more wool, the other breeds are more in favor on account of their mutton, and also because their wool is more easily manufactured by the farmer's family for home use."

In Kosciusko county, Indiana, it is claimed that, while there is little difference in the amount of feed consumed, "fine-wool sheep require more attention than the natives or South Downs, and the latter will endure more exposure than the former."

Mr. F. Beeler, of Marion county, Indiana, strikes a just balance between these breeds in saying, "Were I starting anew in a place distant from market, I should raise Merinoes, while, on the other hand, were I commencing where I could have convenient access to a city market, I should certainly take the mutton sheep."

A farmer in Ripley county, Indiana, writes that he has Cotswolds and South Downs, and sees little difference in the cost of keeping those and the common sheep of the country. A correspondent in Warren county, Indiana, thinks the long-wools are more easily kept than Merinoes, because they are hardier and less pampered. Another in West Virginia notes a similar local preference, and estimates the cost of keeping at the same rate, "except that the fine-wool breeds require more care, being less hardy."

In Pike county, Illinois, a farmer procured in Canada, four years ago, a flock of Leicesters, which have done well and proved pecuniarily satisfactory. His fleeces last year averaged seven pounds, and were sold in Chicago at seventy cents per pound, while the best Merino was selling for fifty-two cents. His wethers, at two years old, weighing one hundred and sixty-two pounds, brought seven cents per pound, with the wool off. A neighbor, at the same time, commenced wool-growing with a flock of Merinoes from Vermont, and now obtains four pounds of wool per head, the last clip of which was sold at forty-five cents, while his wethers, three years old, were sold at five dollars each, unsheared. The Leicester flock has always yielded three lambs to two of the Merinoes. He estimates the keeping of five Leicesters to equal that of seven Merinoes. These cases, side by side, would seem to present fairly the comparative merits of the two breeds, though no single comparison can be deemed conclusive. Even as wool producers, without regard to meat, the comparison is very favorable to the Leicesters, as follows:

Five Leicesters, yield 35 pounds wool, worth	$24 50
Seven Merinoes, yield 28 pounds wool, worth	14 56
Difference, (sixty-eight per cent.)	9 94

The receipts for wethers sold show a still greater difference, amounting to sixty-two per cent. in favor of the Leicesters, in addition to the wool sold, of which no statement of quantity and price is given, as follows:

Five Leicester wethers, 162 pounds each	$56 70
Seven Merino wethers	35 00
Difference	21 70

If such exhibits of actual results do not actually substantiate the superior profit of mutton breeds, they, at least, offset remarkable statements made by Merino fanciers under very favorable circumstances.

In 1850 a wool-grower in Winnebago county, Illinois, bought a flock of 250 Merino sheep and bred them to first class Merino rams till 1859. He then crossed them with South Downs and bred the offspring to Cotswold rams. Carefully recording losses, weight of fleeces, price of wool and mutton, and weight of wool sold since 1851, the following results were exhibited:

Merinoes.—1862: Weight of washed wool per fleece, 3 pounds; weight of fat sheep after shearing, 98 pounds. 1859: Weight of washed wool per fleece, 4½ pounds; weight of fat sheep, 94 pounds; average yield of lambs per 100 ewes, 83; average loss of lambs first winter, 5 per cent.; loss of sheep during the winter, 3 per cent. For several years his wool sold for 15 cents more per pound than that of the Cotswold cross which he afterwards bred, but as the weight of fine fleeces increased, the difference in price diminished.

Cotswold cross.—Weight of washed wool per fleece, 5½ pounds; average live weight, 150 pounds; average price per pound, live weight, of fat sheep, 4½ cents; average yield of lambs per 100 ewes, 109; average loss of lambs first winter, 2 per cent.; average loss of sheep during the winter, 1½ per cent. His last clip brought a higher price in Chicago than the Merino fleeces of the same weight. Of the relative cost of keeping he says: "There is very little difference in the cost of wintering. The Merinoes require more careful management and quite as much grain to get through the winter in good condition. The cross of Cotswolds consume more straw, stalks and coarse food."

A correspondent in Mitchell county, Iowa, reports the cost of wintering two hundred cross bred sheep (Merino, Leicester and South Down,) at $2 55, the the summer keeping upon wild prairie not being estimated; the average weight of wool 4 pounds 2 ounces. Another flock of three hundred "natives" or mongrels, costing $2 50 each in wintering, yielded fleeces of 3 pounds 13 ounces each.

The flocks of Sanilac county, Michigan, are "a mixture of common Leicester, Cotswold and South Down, with a dash of merino." A prominent wool-grower writes that his own flock of 130 "has averaged 5½ pounds river-washed wool per head for the last five years."

The time may come when the profits of wool-growing will cease to be satisfactory even to prairie-farmers. Already there are signs of dissatisfaction. A farmer in Washington county, Wisconsin, with a flock of 116 merinoes, estimates his expenses at a sum equivalent to sixty-one cents per pound for his wool, and figures up an actual loss of $50 28, as follows:

Interest on $467 capital invested about 7 per cent		$32 48
Forty acres timothy meadow		100 00
Forty acres woodland pasture		20 00
Sixteen tons of hay		160 00
Four tons peas and straw		12 00
58 bushels of peas and oats, 60 cents		34 80
One barrel of salt		3 00
Washing and shearing		8 00
		$370 28
Receipts for 464 pounds wool, 50 cents	$252 00	
Receipts for 44 lambs, at $2	88 00	
		320 00
Loss		50 28

In Shelby county, Missouri, "Cotswolds and South Downs are plentier than a few years ago; are very valuable for mutton, sometimes weighing 200 pounds." In one case 190 coarse wool sheep were kept in one flock and averaged 4 pounds 1 ounce per fleece of tub-washed wool.

In those regions where the "improved" Merinoes have not increased the amount of dirt in wool, the difference in wool-producing capacity between coarse and fine wool sheep is not material. Many correspondents, some of whom acknowledge a difference in cost of keeping, give a preference, in point of quantity of wool, to mutton breeds, as in a county in Missouri: "those who have experience in wintering Cotswolds, Leicesters and South Downs think it costs nearly one-third more than the Merinoes, but that the clip of the former is at least one-third heaver than the latter."

The statistical correspondent of the department in Taylor county, Virginia, says: "Our sheep men are improving their stock. They prefer the Cotswolds, Leicester and South Downs to Merinoes, considering their wool more valuable."

Another in Barbour county, in the same State, deems the cost of keeping of fine and coarse wools about the same.

From Louisa county, Virginia, a correspondent writes: "A few Cotswolds, South Downs, and Merinoes have at different times been introduced into this county without any definite purpose of testing the cost of keeping and profits of the *pure breed*, but rather for purposes of crossing. There are a few *nearly* pure Cotswolds. The Merinoes are objected to generally, because it is difficult to card the wool in ordinary cards."

In Gloucester county, Virginia, grade Cotswolds and South Downs prevail, with fleeces weighing about 4 pounds.

A correspondent in Giles county, Tennessee, gives as the average weight of fleeces of his own sheep of different breeds the following figures: South Down ewes, 9½; Cotswolds, 9 pounds; an Oxfordshire ram, weighing 275 pounds, 12 pounds. The Kentucky improved are very popular, and clip from 8 to 14 pounds each.

A farmer in Burke county, Georgia, gives his experience with the South Downs: "I have bred South Downs exclusively for twenty years, and have found them very profitable, and the most desirable as a mutton sheep—yielding a fleece equal in weight, and finer in quality, than the native sheep—maturing in one-third of the time, and surfeiting in fatness upon the same short pasturage, when the native sheep will pine and perish side by side with the Down. For several years many of my lambs died at five to six months old, during the heat of summer, from fatness or apoplexy; but since I have sheared them in July or August, getting a fleece of two to two and a half pounds of wool, my losses have been small, and the lambs are healthier, and by autumn are covered with a sufficiently comfortable fleece. The Downs are hardier, will bear closer folding, attain an earlier maturity, and are a better mutton, than any other race of sheep. I have sold my mutton this season, in February, at $8 per head, fattened entirely on Ruta Baga turnips."

Such testimony of American farmers is abundant. It shows at least that some who have tried various breeds are content to rest their expectations of profit, even in this country of the best variety of Merinoes known, upon the improved English mutton breeds.

INFANTADO AND PAULAR SHEEP.

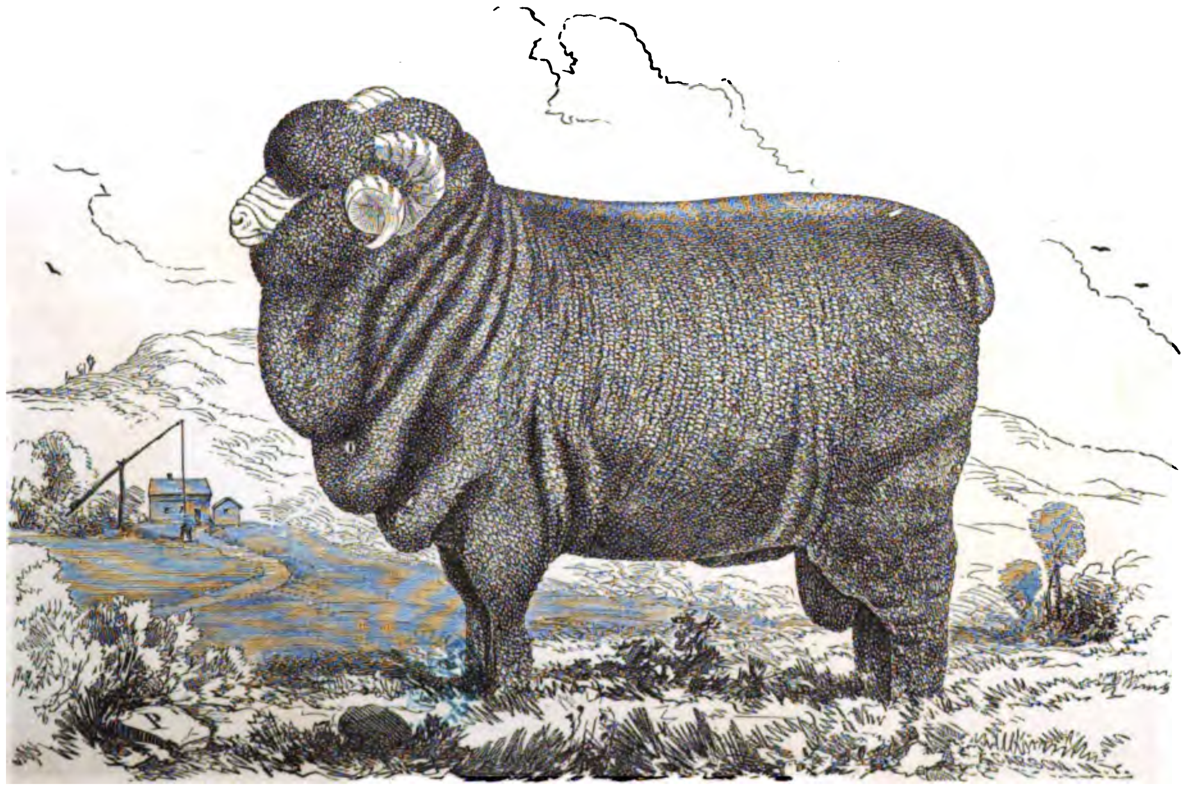
The accompanying engravings represent sheep owned by E. W. Rogers & Sons, Whallonsburg, New York, of which they write: "Our ram General Sheridan was ten months old when the plate was taken, and weighed eighty pounds; weight of fleece when shorn, at eleven months old, was ten and a half pounds. He was bred from a pure Atwood ewe, and sired by a ram named John, purchased of Colonel E. S. Stowell, of Cornwall, Vermont, and which was sired by his stock ram Sweepstakes, the sire of his celebrated stock ram Golden Fleece, thus showing our ram to be descended from the Infantado or Atwood stock. Our group of five yearling ewes, represented in the accompanying engraving, consists of three Infantados and two Paulars. No. 1 is of the same family, on its dam's side, as that of the above-described ram, and was sired by Colonel Stowell's ram Golden Fleece, and sheared at one year old a fleece of ten pounds. No. 6 is of the same blood as No. 1, and was sired by our ram John, above named, and sheared ten and a half pounds. No. 7, same blood on dam's side as No. 6, and sired by the same ram; weight of fleece, eleven pounds. No.

INFANTADO RAM "GENERAL SHERIDAN."

Bred by E. W. Rogers & Sons, Whallonsburg, N. Y.

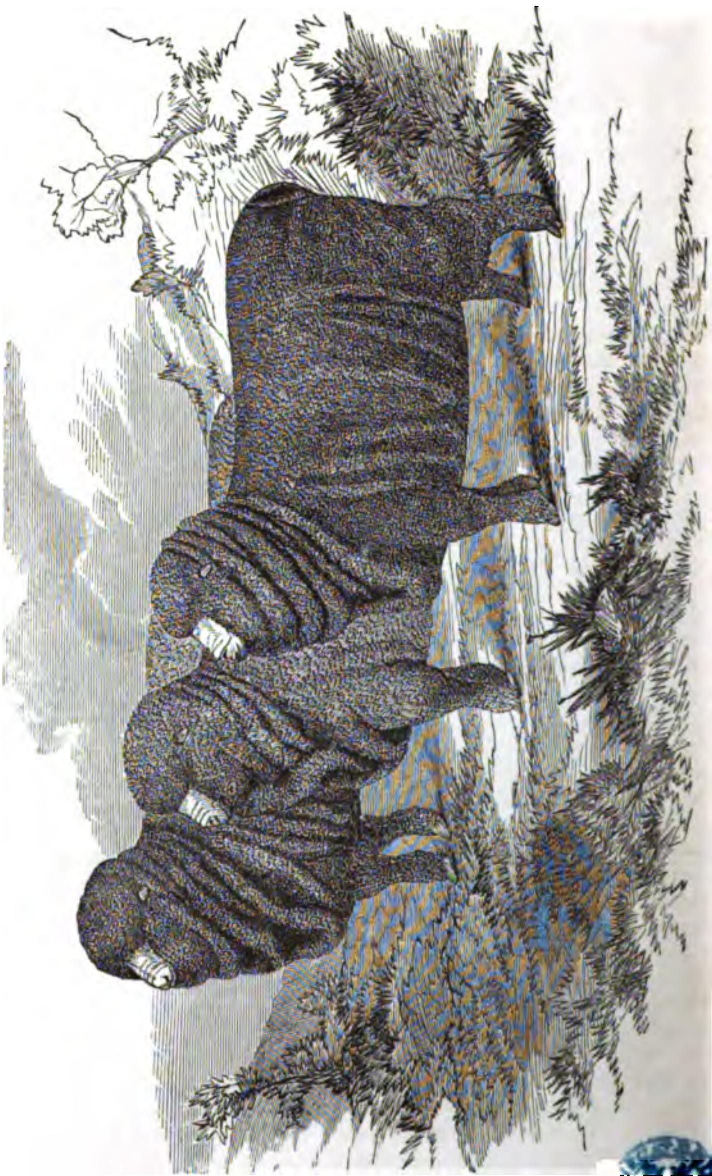
INFANTADO AND PAULAR YEARLING EWES.

Owned and bred by E. W. Rogers & Sons, Whallonsburg, N. Y.



MERINO RAM "ONTARIO."

Property of Hon. E. B. Pottle and John Maltman, Ontario County, New York.



MERINO EWE TEGS.

Bred by F. B. Sawyer, Webster, New Hampshire.

11 is of the stock denominated as Paular, its dam being bred by the Hon. M. W. C. Wright, of Shoreham, Vt., and sired by the celebrated Paular ram known as the Tottingham ram, and owned by B. B. Tottingham, of Shoreham; weight of fleece, ten and a half pounds, shorn at one year old. No. 13, same blood on the side of both dam and sire as No. 11, being sired by the same ram and from one of said Wright's Paular ewes; weight of fleece ten and three quarter pounds."

THE RAM ONTARIO.

The engraving of the Merino ram Ontario, owned by Hon. E. B. Pottle and John Maltman, Ontario county, New York, represents the animal that took the first prize, in the class of yearling Merinoes, at the State show at Canandaigua, in 1865. His lambs received first prizes at the Auburn exhibition, in May, 1867. Ontario is a thorough-bred Infantado, got by Seville, he by Sanford's comet. His dam was bred by Hon. R. J. Jones, of West Cornwall, Vermont. He has a remarkably dense fleece, of fine style and unusual purity.

TRAINING ANIMALS FOR WORK.

BY W. H. GARDNER, CORNING, NEW YORK.

I desire to make a plea for education—the education of animals selected for labor. It is a little remarkable that a people numbering their educational institutions by the thousand should admit their inferior training of animals bred to labor. The half-civilized Bedouin, whose estate is embraced in his horse and its trappings, spends years of patient toil in training it for his use. The development of the animal under such training is wonderful, and as a result, the Arabian stud, in its acquired and transmitted brute intelligence, is at the head of its race.

The shepherds of Judea have for centuries trained their flocks to herd; they *follow* their shepherds into "green pastures, and by the side of still waters;" each animal has a name, and knows its name, and answers the shepherd's call. Both American horsemen and herdsmen can gain by copying the practices of Oriental husbandmen.

There is a great advantage in having all brood animals well and thoroughly trained. The offspring of such are more tractable, have less natural fear of man, and have also, very generally, certain transmitted qualities adding greatly to their value. I am a believer in the improvement or strengthening of the *social* nature of animals by careful breeding, and that association with man and thorough training to labor tends to increase their capacity and usefulness as well as kindliness of disposition. On the contrary, the vices of the parent are quite apt to appear in the offspring. Hence we deem it highly essential that all animals used for breeding, male or female, be thoroughly domesticated and taught *to handle well*, and have no fear of man. In this manner the value of all animals

used for labor may be greatly increased, and the care of farm animals rendered much more pleasant and satisfactory.

In training animals it is necessary to understand thoroughly their nature and habits. One will start at the rustle of a leaf, or any new or unusual sight or sound; another fears not, but with firm step faces real or fancied danger at the bidding of man. All trainers of animals have noticed the wide difference in their temperament: the one is nervous, fretful, and ruinously spirited; the other as quiet and cool as if endowed with reason.

The training of the nervous class of animals should proceed very carefully. Many of this class are ruined early because over willing to labor or "go." It should be remembered that the animal in training is not yet a horse or an ox, but a young creature, without training of eye, limb, or muscle; lacking, also, strength, age, and endurance. Growth and training should proceed together. Light labor and easy driving will be advantageous, while the severe effort of an hour may work complete and permanent ruin.

HABITS IN ANIMALS.

Habit is, with brutes as with men, an iron-handed master. The animal designed for labor may be trained until the most laborious duties are performed as a mere habit. In fixing habits, great care should be exercised that no bad habits are taught. The animal of highly nervous temperament learns very readily and remembers well. A habit, whether vicious or otherwise, once learned, will be returned to or practiced by such an animal long after it is supposed to be forgotten.

"Good spirits," a highly significant term, well understood by all trainers of animals, should be preserved. This condition can be maintained in neither horses nor oxen overtasked when young and growing. We deem this the most essential point in training for work. While in training there is a constant temptation to let the young team do as much as the old one. The important fact should be borne in mind that light labor promotes a hardy, serviceable growth, while the adverse is as above stated.

EARLY LESSONS.

It is one of the first essentials in early training to bring the animal to depend upon the driver. Food, water, care, and training should be mainly by one person. A feeling of dependence as opposed to independence should be cultivated. There should also be a strong friendship, a familiar acquaintance, and the fullest confidence of the animal. The dog, our best trained animal, comes at his master's bidding; is held in check by his voice without bit or bridle; obeys a beck or signal, even when excited and impatient. The same may be done with the horse, with the same long-continued pains and care, the same friendly intercourse, the same fondling and social interchange of endearments.

"Love and love only is the loan for love."

There need be no fear of unreturned affection. All of our domestic animals love naturally the hand which cares for them and the voice which calls them.

The labor is half accomplished when the animal has confidence in and a thorough acquaintance with the driver. Such confidence is always sought by good drivers—men understanding the influences which govern animals, no matter how well and thoroughly trained they may be. No demand should ever be made of a young animal with which he cannot readily comply. It is a good rule to so direct that the easiest way to move is in the very direction you want the movement made. Any and all demands made must be enforced. The trainer never

suffers in the *estimation* of the animal when he succeeds, even if force be necessary to effect the wished-for result.

WHIPPING, URGING, ETC.

It is probably necessary to teach all working animals a wholesome fear of the whip. This done, and its further use is seldom necessary. The whip should not be used in urging to higher speed. The best of all gaits is a quick, nimble walk. Train all teams to walk well. It is the laborer's gait for the farm or road. Speed is rarely worth cultivating.

THE TRAINER.

He who is not most thoroughly under self control should never attempt instructing the ignorance of any, either of his own or a lower race of animals. He cannot succeed well. The voice, the eye, the lip, and motion betray the ungoverned man. How can he govern others, and train in good ways, who cannot control himself? He who would instruct must never yield the slightest evidence of passion, anger, or even impatience. If you train an animal to labor skillfully you have accomplished a victory over a will and physical strength, which, when aroused, are superior to your own. Reason is your strength, good sense your best reliance. How important, therefore, that your mind be free from the dominion of bad habits, enslaved by no excesses. No intemperate man should ever take charge of animals in training.

HINTS ON OVERCOMING BAD HABITS.

Bad habits are mainly the result of want of care or mismanagement on the part of those having charge of the animals. They have no knowledge of when they do wrong or when they do right. They are ignorant of all before them; the past and present alone are theirs. It is an old and true adage, that "ignorance is a blank sheet on which we may write; while error is a scribbled one, from which we must first erase." Erasing bad habits in animals, as in ourselves, is among the most unpleasant labors known to him who has charge of animal natures. Prevention is much the easier and safer method. When a habit has become confirmed, a self-inflicted punishment should be sought for. When such means cannot be adopted, secure enforced obedience, (not by whipping,) and if possible deprive the animal of the power to return to a practice of the habit. Many pernicious habits are the result of overtasking, and come as the result of an endeavor of the animal to obtain rest, shift the burden of the harness, &c. Let it be borne in mind that training or instruction must precede knowledge, and that the brute has neither knowledge of cause, effect, nor our *hope* and *reason* to stimulate to labor. The labor of the animal is obtained through man's power over him; it is not a voluntary offering. Let not, then, that power be abused. Teach! instruct well and carefully, and prove yourself worthy the service of a well-trained, noble animal.

It is highly important that young animals in training for work have easy, well-fitting harness, yokes, &c., that no impediment be offered to their laying out their full strength whenever needed.

If these thoughts shall encourage the young of our land to give humane, yet thorough training to the animals in their charge, then will the object for which they were written be fully accomplished. Thorough training adds greatly to the value of animals and to the comfort of all who use them.

ENGLISH AND AMERICAN DAIRYING—THEIR POINTS OF DIFFERENCE AND COMPARATIVE MERITS.

BY X. A. WILLARD, A. M., HERKIMER COUNTY, NEW YORK.

ASSOCIATED dairying is now conducted on so large a scale, and has so wide a range in America, as to give it distinctive features of nationality. European writers have asserted that this system was first inaugurated in Switzerland, and that America simply borrowed the idea, putting it into successful operation, and therefore is not entitled to any merit as to its originality. Without stopping to point out the great dissimilarity between the associated dairy management of Switzerland and that of America, the truth of history demands the statement that whatever excellence may attach to the American system, nothing in it has been borrowed from abroad.

In the report of the Department of Agriculture for 1865 I gave a brief account of the origin of the cheese factory movement. Having been familiar with its early history, with the men and the causes that led the way to this improvement in dairy practice, I feel competent to speak authoritatively on the subject, and claim its originality as wholly American.

The American factory system now stands pre-eminently in advance of dairy practice in the Old World. By it a more uniform and better product of cheese and butter can be made. These must soon take the lead in European markets, and European nations will adopt the system or be content to see their home products rank as secondary, and sold at inferior prices. Since the adoption of the factory system a large export trade in cheese has grown up between America and Great Britain. The value of American cheese now sent abroad is from seven to ten millions of dollars annually, and as factories improve in the quality of their manufacture, a much larger trade it is believed will be inaugurated.

England is old in dairy husbandry, and has always claimed superiority in dairy practice. A great many styles of cheese are manufactured, and some of them sell in their principal markets at better prices than that made at our factories. American dairymen have never been able to find out wherein this superiority lay. In view of the large trade already existing, and likely to increase, it was deemed important that a better knowledge of English dairy husbandry and cheese-making be obtained. The American Dairy Association, therefore, engaged the writer to go abroad for this purpose, and the following pages are briefly the result of observations over the dairy districts of Great Britain during the summer of 1866.

The dairy lands of Great Britain, it is believed, are no better than in the best dairy districts of America. Pastures there, it is true, will generally carry more stock than ours, because theirs are freer from weeds and better managed. The yield of hay from permanent meadows is no larger than from our best lands, two tons per acre being considered a good crop, but theirs is composed of a greater variety of grasses, is finer, and doubtless more nutritious than ours on account of less waste in woody fibre. Their dairy stock is generally no better than in our first-class dairies. I think there is no county in England or Scotland where the average yield of cheese per cow is so large as in Herkimer county, New York.

In the management of farms they are generally far in advance of us, but in cheese-making their appliances are inferior, their work more laborious, and they

really have but one style of cheese that competes with the best grades of our factory make. This is the cheddar, of which the leading features in manufacture will be found under its appropriate head.

In the cheddar process, as well as in the management of stock of milk and dairy farms, there are, doubtless, suggestions which will be adopted in our practice when their superiority is demonstrated. I have endeavored to call attention to the fact, and to state the point clearly.

THE CHEESE DISTRICTS OF ENGLAND.

The cheese districts of England are grouped together in counties lying contiguous. Thus in the south are found Gloucester, Somerset, Wilts, Dorset, &c., while in the north there are Cheshire, Lancashire, Derbyshire, Leicestershire, and Shropshire. Other counties produce cheese in limited quantities, but not to such extent as to make it a leading business. I went into the southern districts first, and found three styles of cheese, each having a different shape and character, and differently manufactured. They were the Cheddar, the double and single Gloster, and the Wilts.

I had never seen any large tract of country so beautiful as this part of England. It was in June, when the hedges were covered with dark green foliage, the pastures flecked with the daisy and buttercup, flowers celebrated by the poets. But the Engish daisy is not to be confounded with that pest of our fields, the ox-eye daisy, for it is small and unpretending, and does not suck up the life of the land. Then the smooth roads, the villas, the farm-houses, and the hamlets, with their adornments, together with the garden-like cultivation of the land, formed a picture ever to be remembered. For quiet, pastoral scenery, England is surpassingly beautiful. Everything seems to be "picked up" and in place. You see no tumble-down fences, no unsightly stone heaps, disfiguring the land, no cheap wooden houses falling to pieces, no remains of wood-piles and other accumulated trash, like a cancer blotching the premises, but everything seems to be swept up and in order, or, to use a homely phrase, "prepared for company."

SOMERSET AND ITS SYSTEM OF FARMING.

Somerset has a rolling, undulating surface, and it is in this county that the famous Cheddar cheese originated. In form the county is difficult to describe, perhaps partaking more of an oblong figure than any other.

According to recent returns of live stock, &c., its area is 1,047,220 acres, containing 444,873 inhabitants; 84,262 cows; 89,257 young stock; 636,975 sheep; and 75,469 pigs. The surface of the country is generally uneven, and towards the west, on the borders of North Devon, approaching to mountainous. The principal hills lie east and west, and are nearly parallel with each other. These ranges are generally poor, affording pasture for a coarse kind of sheep and some young cattle. The hill tops of the south and southwest are covered with heather. The geological features of the country are varied, and are chiefly composed of mountain limestone, inferior oolite, the white and blue lias, and the new red sandstone. The highest hills are mountain limestone, which has been forced up from its proper place, and is found over-topping the upper strata to a height of six or seven hundred feet. The eastern part of the country is generally oolitic, stretching away northward to Bath, at which place it produces some of the finest building stone in the kingdom. The lias comes next in rotation, cropping out from under the oolite westward. The red sandstone is not so prevalent. This, with the oolite, is the lightest soil upon which large flocks of sheep are kept, which, in the south, are chiefly of the South Down breed, but in the northern district, towards Bath, are crossed with the Leicester, forming a larger and more

remunerative animal. The method of farming is the four or five-field shift—1st, wheat; 2d, green crop (turnips, vetches, &c.;) 3d, barley; 4th and 5th, clover first and second year. The wheat crop is from twenty-four to forty bushels per acre; barley from thirty-two to sixty bushels, sometimes more. A heavier kind of land is found on the lias formation. A team of four horses, or six or eight oxen, is employed in ploughing it. This is more productive of grain than the lighter land, and is farmed in a similar manner.

In some places what is termed a dog flock, that is, young sheep of a year or so old, are fattened for the Bristol and Bath markets. The lowlands and valleys are rich and productive. Between the ranges of hills before noticed are some of the richest plains in England. The vale of Taunton Dean, in the south of the county, is extremely rich. Another nearly level plain extends from the town of Bridgewater to the Mendip hills, and eastward to the city of Wells. Another plain, but rather more uneven, stretches north of the Mendip towards Bristol. These plains are largely devoted to the fattening of beef and mutton for the supply of the local, and also the London, markets. Somerset is noted for its cheese, of which large quantities are made. It bears the name of Cheddar, from a small village at the foot of the Mendip hills. The name originated from the farmers of the village uniting the milk of their cows for the purpose of making a larger cheese. This was done at each other's houses in turn. From that time, which was about one hundred years ago, the thick cheese made in Somersetshire has borne the name of Cheddar, and bears the highest quotations of any English cheese in the London and other markets. It is made much thicker than was at first anticipated. The size that now is in request ranges from 40 to 80 and up to 100 pounds; the shape is from 10 to 14 inches in depth, and 15½ inches in diameter.

This county, and the others south, have suffered very little from the cattle plague. Dairy cows, however, during the past season, have been high, commanding from 18 to 20 pounds sterling per cow, or from 90 to 100 dollars. The dairy cows are motley grades, and so far as I have seen, do not show any better milking qualities than the first-class dairies of Herkimer and Oneida counties, New York.

DESCRIPTION OF STOCK.

The cattle kept in the county at this time are the Devon and short-horn, the former pure of their kind, the latter rarely so, but have been employed to improve the original stock of the country.

The Devons are said to have been formerly (with a few exceptions) a small, three-cornered, nondescript animal, of little use to the dairyman, and less to the breeder and grazier. Their home is South Somerset and North Devon. The race is wonderfully improved through the energy and perseverance of some farmers, who have taken the best animals they could find and bred from them, until they have succeeded in producing one of the best animals of which England can boast. In the opinion of some no beef is equal to it, the fat and lean being so nicely intermingled. Their milking qualities are not yet equal to those of other kinds. A few years since there was a breed called the Hampshire cow, a useful animal for any purpose, of good constitution, size, milk, and beef. Mr. Harding gave me a description of a cow of this breed, nearly the last of the race, which was twenty years old, and had been milked the previous summer, and in the March following went to the butcher at £20 1*s*. I was told that fifty years ago, in the neighborhood of the Mendip hills, they had what was termed the "Mendip cow," of little service but to milk; but both these good, though inferior animals, have passed away, and they have scarcely any cow but what partakes, in a greater or less degree, of the short-horn breed.

QUANTITY OF CHEESE, ETC.

The increased quantity of cheese supplied by this county is not due, it is said, to the change of stock, so much as to the superior management of the present day in feeding stock, clearing the hedge-rows, and draining the wet land, &c. Fewer cows were kept thirty years ago than now. It was then generally supposed that no more could be kept to advantage beyond what half of the pasture or grass land would supply with grass in the summer, and the other half cut for the winter. Now they keep more cows, mow less, and in winter do with less hay; they feed with straw and oil-cake while the cows are dry, so that they get little or no hay till they calve. Three pounds of cake per day (the best American) they say will keep a cow in fair condition if straw be given *ad libitum*. In some particular districts as much as six hundred weight, or 672 pounds, of cheese per cow, it is said, are made. This is on the best cheese-producing land; and this, from long observation, is chiefly on some one of the oolite formations. Not only does it produce the largest amount of cheese, but also of butter. There are no statistics of the quantity of cheese made annually in the county, but from all I can gather, it is from 18,000,000 to 25,000,000 of pounds.

WILTSHIRE.

For diversity and beauty of scenery Wiltshire is not equal to Somerset. Its geological formation, in general terms, may be classed in three divisions, namely, the white lias, which is lowest, the several classes of oolite, and the chalk. According to the late returns the area is 865,092 acres. The number of cows kept is 44,760; young stock and oxen, 32,967; sheep, 596,822; and pigs, 61,012.

The natural division of the county is so *remarkably* distinct, that it must be described accordingly, viz., north and south.

The south part, with a few exceptions, is the chalk district, and forms what is called the Wiltshire downs. Lying high, the land is very thin; still the valleys and slopes are rich for growing grain and turnips. The farms are large, some 1,000 to 2,000 acres. Large numbers of sheep, known as the South Downs, are kept upon these farms. They have black faces and feet, the wool short and fine. The mutton commands the highest price in the London market of any in the kingdom. Though small in size, they will frequently load themselves with flesh, so as to reach 120 pounds in weight. In this district is the celebrated Salisbury Plain, also on the chalk. It is not strictly a plain, except in general appearance; but is beautifully undulating, not unlike the ocean with its long swells after a storm.

The farming of this district is generally the four-field system. In some places, such as on the white clay and the sandy loam at the bottom of the hills, it is worked in the three-field system. All the light land is ploughed with two horses. Neat and good farming is everywhere seen, and it is claimed is scarcely surpassed in England.

North Wiltshire is very different in appearance from the south. The broad unenclosed downs are no more seen, but rather enclosed fields with numbers of trees in the hedges, giving the appearance of forests from the surrounding heights. This is the oolite district and is farmed in much the same manner as the south, being all light lands. The temperature of the climate being warmer, the grain ripens earlier and is therefore less liable to blight.

THE WHITE LIAS AND DAIRY DISTRICT.

The lias is a very small portion and may be merged into the dairy district, which is principally in the middle and northern parts. The cows are short-horns and regarded here as the most useful in England, excellence in milk and meat being alike sought for. A large quantity of cheese is made which finds its way

to the London and other markets. The quality of the cheese is not the best; a little milk butter is usually taken out, but not always, but a large quantity of whey butter is often made. The method of cheese-making is laborious, not so much in the manipulation of the curd as in the salting and pressing and the preparation for market, all being unnecessary labor. The salting, which might and ought to be in the curd, is continued over two or three days, rubbing it in with the hand over the external parts of the cheese, which receives a fresh cloth every time it is salted, which in some instances is twice a day. The cheese is then continued in the press, turned every morning for from four to six days, after which it may venture to the cheese room, which is a large, airy room, supposed to be requisite for properly drying. The cheese is then allowed to throw out a coat, generally blue. This coat must be scraped off and a new one formed, after which it goes to the market, realizing from 10*s.* to 15*s.* under the improved Cheddar price. Wiltshire, up to the 21st of April last, had lost but 99 cattle on account of cattle plague, and I heard of no cases in the county during the summer.

The principal dairy district of Wilts ranges from Westbury, in the south, to Chippenham, northward, around Chippenham and towards Swindon, from forty to fifty miles in length. It is generally narrow from Westbury to Chippenham, and from Chippenham to Swindon from ten to twelve miles wide, and a pretty level tract of country. Before reaching Salisbury to the south you strike the chalk formation which underlies the "Salisbury plains." In going to Salisbury from the north, the chalk first shows itself in a range of high bluffs or hills. The chalk lands are rather light and are worked with two horses, while with the heavier lands three or four horses are attached to the plough. Upon the lowlands the soil is of richer character. In passing through this county one is continually coming upon large flocks of sheep in charge of shepherds—mutton sheep, of course, since the production of meat is always an important element in the resources of British agriculture.

MANNER OF MAKING WILTS CHEESE.

There is nothing in the manufacture of Wilts cheese that would be of any account to the dairymen of America, and it is a matter of surprise that the people of this district are so bound up in old practices as to waste their time and substance in manufacturing cheese of this character. Comparing the Wiltshire method and the apparatus in use with our factory system, the latter is about a century in advance. I give some of the leading features of the Wilts method of manufacture, not for the purpose of benefiting anybody, but rather as a matter of *curiosity*, if I may so term it. I was upon some of the best farms of Wiltshire, and among some of the most intelligent of its cheese-makers, and shall give their best practice.

The night's milk is skimmed in the morning and added to the morning's mess; milk set at 80° and left about an hour to coagulate. It is then broken up with a circular breaker having an upright handle and used as you would push a churn-dash up and down. The breaking is done gently at first. In cooking the mass is raised to 100°, stirring all the time with the breaker. It is then left to rest, and as soon as the curd can be handled it is taken out of scald and put to press. It remains in press 20 minutes; is then taken out, ground and salted at the rate of two pounds of salt to the hundred-weight of curd. It is ground again and put to press. The next day the cheese is taken out of press and salted on the outside, receives a new cloth, and is put back to press, the same course being pursued for two successive days, after which it gets no more salting, but is kept in press eight days, each day being taken out and turned. It is then put into a stone cheese room and left for a week or two and turned every day. At the end of this time the cheese will be covered with mould, when it is put in a tepid bath

or moistened and the mould scraped off, when it goes to the dry room. Here it is turned every day until fit for market, say from 60 to 90 days old, or according to the demand and price. The Wiltshire cheese is less solid than the Gloucester, to which I shall refer hereafter.

At one of the farms I visited, where 60 cows were kept, *and very nice stock too*, the product was a trifle over two pounds of curd per day from each cow, and 1½ pound of butter for each cow per week. Cockey's cheese apparatus was in use, which consists of a tub having a double bottom, the upper one copper, heat being applied between the two, either with hot water or steam; but generally the old-fashioned tubs hold sway. The hoop for pressing the cheese is turned out of a solid block of wood, with a bottom to it pierced with holes for the whey to escape. When put to press some eight cheeses are piled up together, one above the other, and the pressure applied to the lot at one time. The milk pails are made of tin, and hold about 24 quarts; they are formed with a projection or handle on one side and are carried upon the head while taking the milk to the dairy.

The Wiltshire dairies are very cleanly. The dairy rooms are built of stone, with stone floors and whey vats of lead, and everything kept in the neatest possible manner. In this respect they are models, but the amount of labor in cheese-making is very great, and the dairywomen adhere with pertinacity to the old customs, giving no reason for this waste of labor, except that "that is the way we always do." In Wiltshire I found the stock better than in Somersetshire, some attention being paid to breeding. Wiltshire has a great cheese market at Chippenham.

THE CHEESE MARKET AT CHIPPENHAM.

The market place is an open court surrounded by buildings, one side of which is open and supported by pillars, thus giving a spacious place for the stowing of cheese under cover. The open court is nicely paved, and the arcades on either side have a stone floor. The cheese is brought in carts, packed loosely in straw, without boxing. They are taken from the cart and placed upon the stone floors in the arcades, spread out or piled up. Each dairy farmer has his lot together, and they are thus exposed for sale. The cheesemongers or dealers come down from London, Bristol, Bath and other places, and make their purchases. There is a constant hum of voices and tread of feet, as one can readily imagine where a large number of people are collected together intent on selling or purchasing, or are here out of curiosity, or perhaps to meet persons on other business beside the cheese trade. The dealers go about testing the cheese, making their purchases and ordering it to be sent away as sales have been made. No boxes are used in the transportation of cheese as with us in America. The market days here are twice a month, and often, I was told, as much as two or three hundred tons of cheese are in the market during the fall sales. There was a considerable quantity on sale at the time of my visit, all new cheese, and most of it Wiltshire. The Wiltshire cheese is a small flat cheese from 4 to 5 inches thick, 15 to 16 inches in diameter, and taking four to make one hundred weight (112 pounds.) They are inferior to the Cheddar, and very much inferior to American factory cheese, and the highest prices are only occasionally realized.

GLOUCESTERSHIRE.

I think there are no statistics giving the number of pounds of cheese annually produced in Gloucestershire, but some estimate may be made from official returns of the number of cows in the county. It is put at 34,744; loss from cattle plague up to 21st of April, 116. I understand that the losses since that time have not been of much account.

The geological features are the oolite, the lias, and the new red sandstone, the former comprising the principal part of the hills and high lands, the lias the more level and the latter the richer and deeper soils of the valleys, which are chiefly pasture lands, upon which butter, cheese and meat are largely produced. The oolite strata in its varied character runs from north to south, forming the Cotswold hills. Entering Somersetshire, at Lansdown, near Bath, where it furnishes the beautiful Bath stone, passing outward into North Somerset, widening as it enters Wiltshire, soon after which, in the neighborhood of Westbury, it is no longer the surface soil, but becomes loaded with the green sandstone and chalk formation, like the snail which bears its shell upon its back. The Cotswold hills are well farmed in the four, five, or six course systems, according to the capability of the soil. Wheat, barley and turnips are successfully grown. The hills give the name to the Cotswold sheep—which have long been bred and fed there—beautiful animals, with white face, and of highly improved quality, both as regards meat and wool, the latter being long and fine, the fleece weighing from 5 to 10 pounds. A ram will sometimes turn off 15 or 16 pounds of wool. They are generally heavier in mutton than the Downs.

On the western side of the Cotswold hills, extending to the Severn river, and fifteen to twenty miles in length, is what is called the vale of Berkeley. It has every appearance of having been, in past time, covered with the sea. This valley is the chief dairy district of the county of Gloucester. The native cow is of dark color, with a black nose, short legs; is a thick-set, well-built animal; altogether a very useful beast; but the short-horns and Herefords are displacing her.

In the regular Gloucestershire dairies the cheese is made thin, eight of them only weighing one hundred and twenty pounds. They are made twice a day, the work beginning about seven o'clock in the morning, and being finished about ten or eleven o'clock. At five in the afternoon they commence with the evening milk, and finish between eight and nine o'clock. This cheese is known in the cheese-consuming world as the famous Berkeley cheese. If made well it is rich and sweet, and the makers are quite as tenacious of their reputation as those who make cheese worth from ten to twenty shillings *per cwt.* more money. Cows are generally kept, more or less, over the county, except on the uplands. The south and southwest, around the neighborhood of Bristol, are the coal meadows. This district is farmed not so well, comparatively, as the other sections, from various circumstances; being in the coal district, the surface is uneven and the enclosures small, as are, also, the farms; besides, it is near Bristol, at which place hay, straw, and milk are continually sold.

CHEESE APPARATUS AND MODE OF "SINGLE GLOSTER" CHEESE MANUFACTURE.

At a nice farm in the southern part of Gloucestershire, which I visited in June for the purpose of seeing the operations of making "Single Gloster" cheese, the dairy consisted of thirty-five cows. These were short-horns, large, handsome, but not showing extraordinary capacity for milk. The dwelling, dairy, and buildings were all of stone, large, commodious, and everything kept in the neatest manner. The place where the cheese was made was a spacious room with stone floor, clean and well ventilated, and as cool and sweet an apartment as the most fastidious cheese maker could desire. The utensils or appurtenances for cheese making consisted of an unpainted tub for holding the milk, leaden vats for holding the whey, a circular wire curd-breaker, having an upright handle springing from the centre, dippers, skimmers, &c., with two box presses for pressing the cheese. The last were unlike anything I had ever seen, and consisted of large square boxes moving up between standards by means of pulleys and ropes attached to a windlass. The boxes were filled with stones, iron, &c., making a weight of several hundred pounds, and applied directly on the cheese. These presses were very nicely made of dark wood, and varnished,

evidently intended to be ornamental as well as useful. From the manner of their make and the power to be applied in raising the weight, the services of a strong man would be required. The milk was being made up twice a day, making eleven cheeses of fourteen pounds each for every two days, each cheese being about two and a half inches think by fourteen or fifteen inches broad. There was no heating apparatus in the room, and none is required in the "Single Gloster" process of cheese making. As soon as the milk is all deposited in the tub the rennet is added, when it is left to coagulate. As soon as properly coagulated it is broken up with the wire breaker by moving it up and down, which has a tendency to *pulp* the curd rather than break it, as the word breaking is generally understood by our cheese-makers. The mass is then left for the curd to settle, and after it has arrived at a proper degree of firmness to be handled, the whey is dipped off down to the curd, the tub canted up to drain off what whey remains, and the curd gathered to the upper edge of the tub. The whey being removed, the curd is cut across and heaped up, and pressed with the hands to expel as much of the whey as possible, when it is put to press. It remains in press till morning, when it is taken out, turned, and salted on the outside. It is then returned to the press and goes through the same operation from four to six successive days. When taken from the press it is put upon the shelf for a few days, to be turned every day, and finally goes to the cheese room, when it will be ready for market in two or three months, if prices suit. This cheese or drying room is in the upper part of the dwelling house, and the cheeses, when taken here, are placed close together on the floor.

A chance dealer from Bristol, who was present, made a test of the cheeses by walking upon them as they lay spread out upon the floor, which we were assured was the usual method of determining their firmness and solidity. They stood the test of his weight and boots and were pronounced among the best in Gloucestershire.

The hoops in which the cheese is pressed are turned out of a solid piece of wood, and each has a stationary bottom pierced with holes, similar to the hoops used in Wiltshire. In one of the presses I counted fifteen cheeses piled up one upon another, all of which were being pressed together. I think from the above description none of our dairymen will care to make "Single Gloster" cheese, and I cannot see why people there will continue to keep along in the same old rut of their forefathers without making some effort to improve.

I have now presented some of the general features of this great dairy district. The country is well watered by springs and streams, but no better, if as well, as many parts of the central counties of New York. Where watering places are constructed the plan is somewhat different from ours—small ponds being more numerous. The pastures produce, perhaps, more feed than with us, from several causes. In the first place, they are more free from weeds; they are better cared for in top-dressings of manures, while the humidity of the climate produces fresher feed and a greater quantity of verdure.

The permanent pastures have a fine thick sod, filled with a variety of nutritious grasses, among which the following may be of interest in this connection. The sweet-scented vernal grass (*Anthoxanthum odorata*) flowers in May and grows freely in all soils and situations. It is one of the earliest of grasses, and the fragrant odor it affords when dried gives to meadow hay much of its sweetness. Meadow foxtail (*Alopecurus pratensis*) flowers in May and June. Its early abundant, leafy produce is much liked by cattle and sheep, and renders it one of the most valuable of pasture grasses. It forms part of the best pastures and thrives under judicious irrigation. Meadow fescue (*Festuca pratensis*) flowers in June, likes a good soil, and does not attain its full growth until three years from the time of sowing. The produce is nutritious and abundant, and it forms a uniform and abundant turf. Cocks-foot grass (*Dactylis glomerata*) flowers in June and July, grows three feet high and upward, and forms a large portion of all

the best natural pastures, and is regarded superior to most grasses in the quantity and quality of its produce. Its coarse and tufted character makes it unsuitable for lawns. Crested dogstail (*Cynosurus crystatus*) flowers in July, and is found in all pastures. It suffers but little from dry weather, but produces only a moderate quantity of fine herbage. Hard-fescue grass (*Festuca duriuscula*) grows two feet high and forms a portion of all dry pastures, and retains a permanent verdure. It flowers in June. Sheep fescue (*Festuca ovina*) is found in all dry soils from the sea land to a great elevation; flowers in June. Meadow grass, (*Poa pratensis*,) or Kentucky blue grass. It produces an early, nutritious herbage and is regarded as particularly suited to light soils. Rough-stalked meadow grass, (*Poa trivialias*,) fibrous-rooted, rough stalks, forms a portion of of almost all mixtures for permanent pasture-grasses, and is particularly desirable in grounds shaded with trees. Timothy is also found in pastures and meadows, but is not grown to the same extent as with us. Then there are the clovers, the red and white, which are so largely grown with us; and the Alsike clover, (*Trifolium hybridum*,) a true perennial, very productive on moist, rich soils, and will succeed where red clover fails. It is regarded by many as superior to white clover in bulk and quality of produce, and equals it in duration. These are among the leading grasses; and in seeding for permanent pastures, a compound of the best grasses and clovers is used, often as much as two bushels of the light and twelve pounds of the heavy seed to the acre.

I think the question of pastures is better understood in England than with us, and it is a point on which we have something to learn from them. I cannot say that the quantity of grass from permanent meadows, or those long in grass, is larger than is often found with us, but the quality is finer and better—that is, the hay has less woody fibre than with us. At Rothamstead—Lawes's celebrated experimental farm—my attention was particularly called to the fineness of the grass made into hay. The old stocks which have been cut down presented a solid mass of hay almost as fine as hair, and its nutritive quality must have been a third more than our timothy, on account of the less waste or woody fibre.

Allusion has been made to permanent meadows, but generally what we term meadows, that is, land devoted to the production of hay, are treated very differently from ours. Much of the hay is grown on what is termed the four or five course shift. It comes in regular rotation after grain crops. It is mowed once or twice, and then broken up for a crop of wheat. Various mixtures are sown, and large yields often result. I went upon a splendid meadow, in Devonshire, where the yield of grass upon the ground must have made at least two and a half tons of hay per acre, and perhaps more, and it was the first crop. The seeding per acre was as follows: Eight pounds of red clover; two pounds of white clover; four pounds of trefoil; three pounds of Peek's Italian rye grass. This is not given as an illustration of the best mixture, but rather as a specimen of what our farmers would term heavy seeding. Lands often get more and a greater variety of seeds.

Perhaps I am occupying too much space by going so minutely into details; but I feel earnest for the success of American farmers, and have thought that it might be of interest for them to get a little insight into the manner in which dairy farms are managed abroad. Perhaps this may be appreciated the more, when they are told that a farmer in the dairy regions of England often pays from \$3,000 to \$3,500 per annum in rents and taxation for a two-hundred-acre farm. He pays this for the land alone, and gets no use of any personal property whatever. He then stocks it at his own expense. He is at all the cost of utensils, labor, and of keeping the farm in repair. As the wealthy or "well-to-do" farmer, for the most part, never lays his hand to any labor beyond superintendence, one might naturally conclude, as I did, that pretty shrewd management at least is required to pay this sum, support his establishment, and lay up money from his business.

By the judicious use of capital and the liberal use of fertilizers, and by a system of mixed farming, he is able to accomplish these results. It is true, labor

is cheap. He pays his laborers from 30 to 40 cents per day, and in harvest a little more; but he does not board them. They have cottages—good, substantial buildings—and little gardens. These cottages, like the more pretentious mansion of the farmer, are erected by and at the expense of the landlord; but a certain number of people go with the farm, and they pay rent to the farmer for their cottages, say about a shilling per week.

The condition of the peasantry is, in many respects, most wretched; but that need not be discussed here. The farmer's position is infinitely above them, and he lives, for the most part, the life of a gentleman. He is a man who is expected to have some means, say from £8 to £10 per acre; or, in other words, a floating capital of from $40 to $50 for every acre of his farm. This he uses in his business, purchasing stock and fertilizers, and making such improvements as he judges will pay him back remunerative profits.

And here I cannot do better than introduce the reader to Mr. Harding, of Marksbury, the great exponent of Cheddar cheese-making in England. Mr. Harding is perhaps sixty years old, and learned the great and essential principles of cheese-making from his ancestors. He has simplified the process of manufacture, and helped to reduce it more to a science; but he does not claim to be the originator of the Cheddar style. He is an intelligent, companionable man, with a rich vein of humor in his composition. A brief view of his mode of management will serve as an illustration of the manner in which dairy farms are conducted in the south of England, although, in some respects, Mr. Harding's practice differs from that of others.

MR. HARDING'S FARM.

The farm may be regarded as of rather inferior land, some of it a compact, tenacious soil, requiring a four-horse team to plough it. Comparatively, he places the farm under the head of middle-class lands, and when he first came upon it, it was considered unadapted to the dairy. But, for illustration, it will serve our purpose better than to take some extra farm, since a nearer approximation will be reached to average results.

The farm consists of 300 acres, 200 of which are in permanent pasture and meadow, and 100 acres arable land. The farm is hilly, and rises from the new red sandstone, which is the poorest part, to the white lias, which is level, and upon which lies the arable portion, and again rising to the oolite, which is the best part of the farm. The permanent grass lands are used alternately for pasture and meadow, the change being made annually. Mr. Harding making good cheese, which sells at a high price, believes it more remunerative to convert as much as possible of the arable land into milk. A considerable portion of the arable land is devoted to grasses that will come early, to supply the cows in spring. The arable land is managed as follows: First crop, wheat; second, turnips, vetches, tares, &c.; third, barley, when the land is seeded with rye grass one bushel, trefoil ten pounds, red clover four pounds, white clover three pounds, per acre. Upon these grasses the cows are pastured two seasons, when it is broken up in August or September and sown with wheat in October, without additional ploughing. After the wheat is harvested, a portion of the stubble is immediately ploughed and sown with winter tares, for feeding sheep early in spring. Another portion is sown, at the same time, with *trifolium incarnatum*, (Italian crimson clover,) another part is sown in February with spring tares, and the balance to Swedes and other turnips. All this feed is to be consumed for the feeding and fattening of sheep, from which one to two hundred are kept.

The sheep are purchased in August, at from six to eight months old, at prices ranging from $7 50 to $10 each, and the next season, after shearing, are sold at from $15 to $20 each. In fattening the sheep, they are hurdled and fed on the turnips, vetches, &c., with corn or cake, say of the latter at the rate of half

a pound each per day. The turnips are grown in drills, with an application of from five to six hundred pounds of superphosphate per acre, leaving the principal part of the farm-yard manures for the permanent grass lands, upon which are kept from sixty-five to seventy cows, half a dozen heifers, and eight horses. Thirty-five dollars per ton are paid for the superphosphates.

The cows are grades partaking largely of the short-horn blood, of good size, with a view that, when failing for the dairy, they may be turned to a good account for making beef. Mr. Harding keeps more stock than he grows hay for in the winter, thinking that grass is far more valuable than hay, and he makes up the lack of fodder by giving two parts straw and one of hay, cut to chaff, with three or four pounds of oil-cake per day to each animal. The cows yield about 450 pounds of cheese, each, annually. They "come in milk" in February, and cheese-making commences about the first of March. The calves are sold to the butcher, when a few days old, as is the practice of some of our own dairymen. The cows are not kept in barns or close stables, as is the practice in New York, but are tied in sheds built of stone, the floors nicely paved. In these they take their place during summer, night and morning, for milking, and each milker is allotted seven cows. Tin pails are used for milking, and the milkers place them on the head when carrying the milk to the dairy.

The pig in this dairy forms an important item of profit. A hundred or more are fattened during the year on barley meal mingled with the whey, which annually realize about $7 50 per cwt. after paying for the meal. The hogs are of the Berkshire breed, and very fine ones. They are kept in a nice, spacious, stone piggery, cleaned and bedded every day. The barn is a large stone building, provided with water-wheel, to which is attached the threshing machine, chaff cutter, and stones for grinding the grain.

The dairy house is connected with the dwelling, and is a model of neatness, being built of stone and provided with Cockey's apparatus for cheese making, a tolerably good apparatus, but much inferior to our factory vats. The milkers are not allowed to come into the dairy, but pour the milk into a receiver at the window, which conducts it to the tub. The whey passes off through the pipes to a cistern in the piggery, where it is pumped for the pigs.

The production of hay on permanent meadows of this farm is generally at the rate of 3,800 pounds to the acre. Farm-yard manures are not allowed to accumulate in the yard, but are taken to the field where they are to be used and there piled. Here it is turned until pretty well rotted. When it is spread upon the lands to be mowed it is applied at the rate of twenty cartloads per acre, and brushed down fine.

Results.—Under this system the average annual receipts and expenditures are as follows, the calculations, of course, being upon a gold standard:

Cheese sold		$5,000
Profit on sheep, including wool and mutton		500
Profit on pigs		600
Grain sold		1,800
Calves and butter		250
Total		8,150
The expenses are:		
For rent	$2,500	
For tithes	450	
For poor rates and taxes	400	
For labor	1,750	
		5,100
Leaving an annual profit or balance of		3,050

The number of male hands employed, including boys, is ten. They get on an average thirty-three cents and three pints of cider each per day. In harvest the men get fifty cents per day; these sums always including the cost of board, since in England the hands do not live in the farmer's family, as with us, but find themselves in board. The two girls in the house are paid thirty and fifty dollars per year and board.

These figures were given me by Mr. Harding as his average result of profits. To this should be added, doubtless, the value of the food consumed in the family. No items were given for beef sold, since these were made to balance depreciation of stock, purchase of oil-cake, &c. No comment need be made on the foregoing, because among practical men each will make the necessary comparisons and draw his own conclusions as to whether his own or this is the best system of dairy farming. But if any can show a better balance sheet, in *gold*, from a poor farm of this size, he is doing well.

CHEDDAR CHEESE MAKING.

Having described the Gloster and Wilts process of cheese making, I will say something of the Cheddar process. The improved English Cheddar cheese is regarded by Englishmen as the finest cheese that is made anywhere. It suits the general taste better than any other description of cheese manufactured. The fact that Cheddar always commands the highest prices; that there is an immense demand for it; and that its manufacture has become more scientific and thorough than that of any other kind, make it important for us to study its character. I was among the Cheddar dairymen for more than two weeks, studying the process of manufacture, and saw some of their most noted dairies. I was at Mr. Gibbon's, who was awarded the gold medal for the best dairy at the international exhibition, at Paris, and at Mr. Harding's, of Marksbury, Mr. McAdam's, of Gorsly Hill, Cheshire, and others, and after having seen all the different styles of cheese in Great Britain, I am of the opinion that the Cheddar is the only process from which the American dairymen can obtain suggestions of much practical utility.

I may remark here that John Bull, like his blood relation Jonathan, is a man of strong prejudices, and will often prefer a Cheddar cheese of no better quality than good American, at 10*s.* to 15*s.* per cwt. more in price, simply because the English Cheddar has a better reputation. This feeling has very much to do in regulating the difference of price between the best samples of cheese of the two countries. But laying all prejudice aside, I must, in truth, say that we have not yet been able to surpass in excellence the fine specimens of English Cheddar. It is a very high standard of cheese, and is deserving of all the encomiums which it has received from time to time. The quantity of extra Cheddar made in England is comparatively small, and its peculiar excellence has been rarely reached in American dairies. Its requisites may be briefly summed up in the following points:

1. Mildness and purity of flavor.
2. Quality, which consists of mellowness or richness under the tongue.
3. Long-keeping qualities.
4. Solidity or freedom from eyes or holes.
5. An economical shape as regards shrinkage, handling, and cutting.

It is not within the range of a brief paper like this to go minutely into all the details of Cheddar-cheese making, but rather to present points of difference between their process and our own.

In the first place, the English dairymen have a cleaner and better-flavored milk than generally obtains with us. The milking is performed with great nicety in tin pails. The milk rooms are perfect models of neatness. They have stone floors, and the joints of the flagging are cemented together, so that

no slops or decomposed milk can have an entrance. They are situated in a cool, airy place, and the walls are of stone or of hollow brick, thus rendering them cool and of even temperature. Every part is well ventilated and out of the reach of disagreeable or fetid odors. The floor, the utensils, and cheese apparatus are kept as sweet and clean as the table and crockery of the most fastidious housekeeper.

This condition of things I found universal wherever I went among the dairymen—at the royal dairy, near the Queen's palace at Windsor Castle, and radiating thence through all parts of England. Nothing connected with cheese-making abroad struck me with more force and admiration than this perfect neatness and cleanliness of the dairy. In this respect they are greatly in advance of us; and, in my opinon, it is one of the chief reasons why they are able to obtain that fine, clean flavor which is a distinguished characteristic of their choice cheese.

There is nothing, perhaps, which indicates the progress and skill of our manufacturers more than the fact that they are able to take imperfect milk from the hands of patrons, manipulate it among the fetid odors of whey slops and decomposed milk, and yet turn out a cheese that will compete with the great bulk of English make. But these conditions will not and *cannot* produce the fine, delicate flavor of the best Cheddar, and it is one reason why there is such a great bulk of American cheese condemned abroad as "not just right in flavor." Now this putrid inoculation does not show its whole character at first, but, like an insidious poison in the blood, increases from week to week, until it puts on a distinctive feature which spoils all the good material with which it comes in contact.

I saw American cheese abroad, perfect in shape and color, rich in quality, splendidly manufactured, and having a bright, handsome appearance, that would have placed it on an equality with the best in the world; but the trier showed a flavor that could be plainly traced to a bad or imperfect condition of the milk before manipulation. I have been extremely mortified, while testing cheese abroad, to catch the taste and smell of putrid rennet and of the stables. This is one point of difference between the dairy practice of the two nations. In the Cheddar process the milk is at a low temperature, from 78° to 80°, using some whey with the rennet according to the condition of the milk. After coagulation is perfected, which takes from forty to sixty minutes, the curd is cut in large checks, and soon after they commence breaking with a wire breaker attached to a long handle. The breaking is at first slow and gentle, and is continued till the curd is minutely divided. This is effected before any additional heat is applied. They claim that the curd cannot be properly broken at 90° or above 90°, and that there is a better separation of the whey and condition of the curd by breaking minutely at about 75° or 80° without an increase of heat during the process. This process of minute breaking in the early stages of the curd appeared to me to result in loss of butter, and this is the chief reason, I think, why Cheddars have less butter in their composition than our best American. That it does not result from inferior milk is shown from the quantity of whey butter manufactured. The breaking at Mr. Harding's usually occupied a full hour. The heat is raised in scalding to 100°. Their cheese apparatus is inferior to ours, and hence I think that part of the process is not capable of being done so well as with us, since heat is not applied so evenly to all parts of the mass; but from this point there is a wide difference in the treatment of the curds.

When the curd has reached a firm consistency, and the whey shows a slightly acid change—*a change so slight* as to be detected only by the experienced observer—it is immediately drawn and the curd heaped up in the bottom of the tub. I am not sure but that this early drawing of the whey is an improvement.

When in London I had some conversation with Dr. Voelcker, the celebrated chemist of the Royal Agricultural Society. Among other things he said:

"One of the greatest faults of cheese-makers is in the application of heat. Many use too high heat. The lower the temperature that can be used, and the more uniform or evenly it can be applied, the better flavor will obtain to the cheese.

Another point of importance in cheese-making, and one not generally understood, is in relation to the whey. It should be drawn off, got rid of just as soon as possible, or as soon as consistent with the necessary operations." He would draw the whey sweet. The reason he gave was, that "you can never tell what matter you have or what you are dealing with in the whey. It may contain taints of the worst character. You cannot well determine the degree of its acidity, and hence great risks are run in steeping the curd for a long time in the fluid." He would prefer to draw the whey as early as possible and allow the curd to undergo the proper change and arrive at maturity heaped up in the bottom of the vat.

Soon after the whey is drawn and the curd heaped, it is cut across in pieces a foot or more square and thrown again in a heap to facilitate drainage and develop further acidity. It remains in this condition for half an hour, the whey meanwhile flowing slowly from the heap, when it is taken out of the cheese tub and placed in the sink or cooler. It is then split by the hand into thin flakes and spread out to cool. The curd at this stage has a distinctly acid smell, and is slightly sour to the taste. It is left here to cool for fifteen minutes, when it is turned over and left for the same length of time or until it has the peculiar mellow and flaky feel desired. It is then gathered up and put to press for ten minutes, when it is taken out, ground in a curd-mill, and salted at the rate of two pounds salt to the cwt. (112 pounds) of curd. It then goes to press, and is kept under pressure two or three days. The curd, when it goes to the press, has a temperature of from 60° to 65°, and when in the sink it is preferred not to get below this point. A proper temperature is retained in the curd during the various parts of the process, in cool weather, by throwing over it a thick cloth. It will be seen that, the whey being disposed of at an early stage, the attention of the manufacturer is to be directed only to one substance—the curd. By draining the whey and expelling it under the press, and then grinding, a uniform incorporation of this material is effected. The cooling of the curd before going to press, and the removal of the cheese, after pressure, to a cheese room, where an even temperature is kept up, differing but little from that of the cheese when taken from the press, effects a gradual transformation of the parts into that compact, mellow, flaky condition which is characteristic of the Cheddar, and at the same time preserves its milky or nutty flavor.

Now, apparently, there is nothing difficult in the process; but the great art in this, as in other methods of cheese-making, is to understand the condition of the milk and the state of the curds during their various manipulations. This cannot be described, but can only be learned by experience. The process, however, is more easily acquired than that usually practiced at the factories, since the whey being got rid of, the curd is placed under better control of the operator, and the pressing, grinding, and salting must, in this respect, make a more uniform product.

We can scarcely yet appreciate the part that chemistry plays in the manufacture of cheese. We use a chemical agent—rennet—the nature of which even the most learned chemists do not fully understand. We note the changes that this produces in the milk and manipulate it in its new condition. We then employ heat, another agent, and develop an acid; then another agent—salt; and what wonder that, in all these conditions and changes, the careless and unskillful operator should fail in the quality of the article which he produces or the standard which he sets out to reach?

The most profound chemists are often thwarted in their operations by inexplicable conditions which, at first sight, seem easy of solution. Thus, for instance, take four well-known substances, viz., grape-sugar, corn-sugar, starch, and wood, each of which is made up of only three elements, carbon, hydrogen, and oxygen, which it must seem easy to use so that either of these substances could be converted into the others. There is very little difference, it will be seen, in the composition of any of these substances, and yet how widely different are they to our senses. It would seem a very simple thing to convert one of these substances

into another by merely adding or subtracting an element, yet we find that the most expert chemists experience the greatest difficulty in bringing about a result which nature is constantly accomplishing in her silent laboratories. The more we can reduce cheese-making to a science, and confine it within certain rules, the better will be our practice and the more uniform our product. It may not be advisable to adopt any one system exclusively, since fine cheese can be made by various methods; but the study of the cheese-maker should be to seize upon a good point whenever he can find it, and combine it in his own practice. Mr. Harding believes a sharp-cutting instrument in breaking the curd is injurious, and that the curd should be allowed to split apart according to its natural grain; other persons in England, quite as good cheese-makers, believe in sharp-cutting implements; of these I might mention Dr. Voelcker, of London, and Mr. McAdam, of Gorsly Hill, who has not only written well on cheese-making, but has done much in introducing the Cheddar system into Scotland and Cheshire. Of this, however, we may assure ourselves: by no system can good cheese be made unless the manufacturer studies his business, and learns, by close application, by observation and experience, the changes that are going on in the process with the whey and curds, and can properly manipulate them.

CHESHIRE CHEESE MAKING.

I suppose that many of our cheese-makers would hardly suspect that a really fine, delicious cheese could be made by the following process, which is the one in general practice in Cheshire; and yet some of this cheese cannot be surpassed in flavor and excellence. The Cheshire mode of cheese-making is somewhat peculiar, and, to an American, would be called decidedly antiquated. The night's milk is usually set in pans and added to the morning's mess, when it is set with rennet at a temperature of about 75°. Often no heat is applied—the morning's milk being sufficiently warm to keep the mass up to the desired temperature for setting. After the rennet is applied, the coagulation is perfected in about an hour, when it is carefully broken up with a wire or tin curd-cutter, of similar make to the old American curd-cutter.

The breaking being perfected, and the curd becoming sufficiently firm, without any additional heat being applied, the whey is dipped off. The curd is then lifted into a drainer or kind of sink, where the whey can drain off more thoroughly, and from time to time the curd is cut across and heaped up, so as to facilitate a more thorough separation of the whey. It is then salted, by guess, and ground in a curd-mill, when it is put into the hoop, but not immediately to press.

The hoops, filled with curd, are set in a warm place for a day or so, generally in a kind of oven constructed for the purpose; and, on the second day, are put under press. Here they are kept several days, as in the Wiltshire and Gloucestershire districts. The hoops have no followers. They have a bottom pierced with holes, which is stationary. A strip of tin, four or five inches wide, is placed about the curd on the inside of the hoop, or above it, so as to raise the curd above the top of the hoop. A board is now thrown or placed on top of the curd, and as the press is applied, the tin sinks down with the curd until it is pressed even with the hoop. If the cheese is not found to be solid enough, another hoop, of less height, is used, and the tin put around that portion above the hoop, and pressed in a similar manner. Many of the presses are nothing but large square blocks of stone raised by a screw. They are rude affairs. The bed pieces on some are of stone, with a flue beneath for conducting heat, in order to keep the cheese warm while pressing. The milk is worked up into curd, and the utensils cleaned up every day by twelve o'clock m.

It was really a matter of surprise to find that fine cheese could be made by this process, where everything is done by guess, and where all the operations are so different from our method. But a great deal of poor cheese is made in the

Cheshire dairies, and as a whole is inferior to our factory make. That which is the best is as fine in flavor and quality as any cheese made, and will command the highest prices. The texture of Cheshire cheese is different from the Cheddar, being what is termed "open meated," that is, loose in texture without being porous. Their best cheese appears richer in butter than the Cheddar.

I have merely given the outlines of the Cheshire mode of cheese making, as a matter of curiosity. In my judgment there is nothing in the process adapted to America, we being at least fifty years ahead in our appliances and mode of manufacturing. I must say this, however, in favor of Cheshire dairymen: everything connected with the dairy is kept scrupulously clean. The floors, the utensils, and every part of the dairy are sweet and clean. And here, perhaps, is the secret, or at least a part of it, of the fine, clean flavor of their best cheese. During a portion of the time the Cheshire cheese is undergoing the process of curing, the cheese is placed on straw or hay upon the floor of the curing room.

APPEARANCE AND COMPARATIVE MERITS OF AMERICAN CHEESE ABROAD.

Having now described the manufacture of the leading styles of English cheese, it may be well to say something in regard to the appearance of American cheese in England, and what is thought of it in the foreign markets. I went into nearly all the principal market towns in England from the south to the north, and heard hundreds of people discuss the merits and faults of American cheese at the storehouses, the shops, and at the table. I took much pains to get at the true state of feeling in the country, and I think I may safely say that American cheese to-day, as a whole, has more quality and is better manufactured than the bulk of English cheese.

I have given them the credit of producing a limited quantity of cheese of the finest type that has ever been reached by any manufacture, but the quantity is comparatively small, and when the whole bulk is considered, there is nothing like the richness and uniformity of that from our factories. This is not only my own opinion, but that of many of the best judges of cheese in Great Britain. I have been at hotels where American cheese is always purchased in preference to English, and I have been amused to hear Englishmen contend that no such cheese could be produced in America, and nowhere else except in the best dairies of England, but who were forced to give way on pointing out to them the bandage, which is an indisputable proof of American manufacture. Country dealers, cotters, middlemen, and skippers admit that the highest grades of our factory cheese have more quality and are superior to the general run of English make.

I have often heard dealers declare in a spirit of vexation that if the Americans continue to progress in the ratio of the last four years, two or three years more will place their cheese at the top of the market, and English make must rank secondary. They say the Cheshire dairymen are "dough-heads" not to try to keep pace with modern improvements. I have seen a dealer look at American and English cheese side by side, and while admitting that the American was in every respect the best, take the English at a higher price, because, as he said, some of his customers had such foolish prejudices that they would not try the American, and therefore could not judge of its quality. A leading dealer in Manchester told me he had many times tried to introduce American cheese among certain of his customers, and that they would not purchase. By and by, when they sent up an order, he would slip in a few of nice grade factory make, and after that the customer would be eager to purchase, declaring he never cut up better cheese.

Now, this is the condition of things all over England; there is prejudice to overcome, because formerly our cheese was of bad character, and there is a feeling that it is of such perishable nature that it will spoil if not immediately consumed. These remarks apply to our nice grades of cheese. There is another

class of our cheese that comes into market that does great injury to sales. It is cheese that is rich and well made but of bad flavor. This, and large shipments of inferior make, the accumulated refuse from good and indifferent lots which cannot be sold alone, are mixed up with good samples and shipped abroad to clean out New York storehouses.

These lots drag on the market; they are constantly accumulating, and sales are forced, which breaks the market, besides carrying a prejudice wherever they go against American cheese. As to the outward appearance of American cheese, as I saw it abroad, it is generally good. Of course some of it comes to hand soft, melted, and in wretched condition, but generally the great bulk of factory make comes in store quite as bright and handsome as does the English manufacture. Many of the large dealers told me they had never had American cheese come to market with handsomer outward appearance than this year's (1866) make. And I think in getting the comparative merits of the cheese of the two nations we have often been misled and wrongly informed. Great condemnation has been made of our poor cheese, all of which was well deserved, but while great stress has been laid upon this, there has been a studied care to conceal the merits of our best goods.

This is but natural. Men engage in the cheese trade to make money; they run great risks, and cannot be expected to post others up to their own disadvantage. The laws of trade are "to buy cheap and sell dear;" and so, after all, perhaps, they are not so much to blame.

Some of the dealers, acting in concert with parties in New York, take great pains to keep factories which make prime cheese in ignorance of the fact. The factory names are erased from the boxes, and so customers are supplied with a line of cheese which they can only trace to the private brand of the dealer. Some have acquired in this way quite an enviable reputation for handling choice American cheese, and have made largely by the practice. It is a great damage to the factories, since other dealers are kept ignorant of the brands, and cannot enter into competition for the purchase. I know of no way for this to be remedied except by branding the name of the factory on the bandage. Perhaps a good way also would be to have the name of the factory neatly cut in rather broad letters upon the pressing follower, so that the cheese, when pressed, will show the name of the factory in raised letters. There is no difficulty in this, and no hurt will result to the cheese. I have seen samples of English cheese where elaborate figures were raised upon the surface in the manner suggested, but I would not advise any "gingerbread work"—nothing but plain carving.

STYLES OF CHEESE DEMANDED.

The styles of cheese demanded for the trade will depend somewhat upon the market for which they are intended.

In London small Cheddar shapes of forty, fifty, sixty, and seventy pounds are popular, and will command an extra price over cheese of large size of the same quality. The true Cheddar shape is fifteen and a half inches in diameter by twelve inches in height, and by preserving this proportion for larger or smaller cheese that style is obtained. Cheddars are made varying in size from those named up to eighty and one hundred pounds, but the larger are not so common. A limited number of those weighing one hundred pounds would readily find sale.

Those weighing about seventy pounds are not objectionable, but the smaller sizes are of readier sale, and often on account of their size bring better prices. It costs more, however, to manufacture small cheeses, and there is greater loss in shrinkage; so this ought to enter into the account in determining the size that will be most profitable. It would be well for factories to make two sizes of Cheddars, regulating each somewhat in accordance with their own convenience. The Cheddar shapes are popular all over England, and therefore may be regarded as best adapted as a general rule for our factories to make for exportation.

There is another style called the Derby shape, which, when made of fine quality, brings the highest prices. It is a small, flat cheese, fourteen to fifteen inches in diameter, and two and a half to three inches thick, and weighing twenty-five to thirty pounds. If care be taken in boxing, two cheeses might be put in a box, and thus the expense on that score lessened. There should be two heavy scale boards between the cheese, and none but well-made, substantial boxes used.

There is a moderate demand for our old-fashioned shaped cheese—that is, a cheese half as high as its diameter, and weighing from sixty to eighty pounds, but it should not exceed one hundred pounds. In Liverpool a variety of styles are worked off readily. Several of the dealers there told me they had no difficulty in disposing of cheese weighing 120 to 150 pounds, providing it was all right as to quality and flavor; but I am satisfied, after going among the country dealers in different parts of England, that preference is always given to cheese of smaller size when the other qualities are satisfactory.

COLOR.

The matter of color is a question which has long occupied the attention of American dairymen, and upon which very indistinct notions have been entertained. This is not to be wondered at when the different markets in England give preference to a variety of shades, and different dealers ask only for the color of their particular market. The Londoner likes a cheese of considerable color, something like the rich shade of butter made when the dandelions are in bloom. It must be clear and pure; not lemony or dirty, or mottled through the cheese, but a rich shade of cream that gives a pleasing effect to the eye, thus serving to heighten the imagination that a delicious morsel is before you.

London is the grand metropolis of the world, where wealth is unbounded. The best articles of food readily find a market here, and command the highest prices of any in the kingdom. If they can only get the *best* they are willing to pay for it, and this is the reason why choice cheese never goes begging at top prices.

When I went through the Manchester cheese markets they told me that colored cheese was a drug and did not suit that market. A very extensive dealer had just returned from Liverpool, disappointed in not obtaining a supply of pale-colored cheese. In prices, quality, and shape, he said, there was no difficulty in being suited, but his customers insisted upon an uncolored article, and as that was not to be had he did not purchase. It was in this man's storehouses that I saw some of the Herkimer county, New York, "coarse curds," and they were commended for their texture and quality. There are large quantities of pale-colored cheese made in England, and considerable of the high-priced Cheddar has no color except that which results from the natural condition of the milk.

I went down to Chippenham to see the great annatto manufacturer, Mr. Nichols. His preparation bears the reputation of the best in England, and I thought it might be worth while to have him send over samples, and thus have an article that was approved by English dealers. Mr. Nichols was willing to send out samples on my assurance that they would be properly distributed; but when I reached London I learned from the chemists a secret which is worth a good many thousand dollars to American dairymen. It is, that all preparations of annatto depend for their excellence, not so much upon any patent for dissolving or cutting the crude annatto as upon the *purity* of the annatto itself. All the best English liquid annatto is cut with potash, so that American dairymen can just as well make their own coloring material as to send abroad at great expense for the English article. But it is important that we obtain a *pure article*, and this can only be secured by purchasing of a reliable person who is a good judge of it. If you use a bad article you are sure to get a bricky, uneven color, which is so objectionable, and which reduces the price of the cheese.

BANDAGES, BOXES, ETC.

In regard to bandaging and boxing I may remark that no cheese should be made in America for shipping abroad without having a bandage upon it, and without being put up in a strong box with heavy scale boards. I have seen considerable quantities of English cheese in the storehouses split open at the sides, a prey to skippers, and upon which losses were sustained. The Cheddar dairymen put a coarse linen bandage upon their cheese during the process of curing. It is brought round tight and temporarily secured. Some work eyelet holes at the ends of the bandage and bring it snugly about the cheese by lacing, as you would fasten a shoe upon the foot. These bandages are stripped off when the cheese goes to market.

The cheeses would be better protected if they had permanent bandages, on our plan, and some of the English dairymen advocate its introduction in their dairies. By not bandaging something might, perhaps, occasionally be gained in helping the English dealer to deceive his customers by palming off our cheese as of English manufacture; but good factories would lose their identity, and the loss from breakage and other sources would overbalance, by far, this advantage. Besides, it should be our object to make for American cheese a reputation that shall stand unchallenged as the best in the world.

DEFECTS IN AMERICAN CHEESE—BAD FLAVOR, ETC.

We come now to consider the two leading defects in American cheese—porosity and bad flavor; and the last may be said to-day to overbalance all the other defects put together, *two* or *three* times over. I need not waste time upon that character of cheese known as soft, spongy, or salvy, or the poor grades which come from carelessness, inefficiency, or ignorance in manufacture. Good cheesemakers know at once how these may be corrected, but I refer to the better class of cheese made at factories. The English acknowledge that the American factories stand unrivalled as sending out a cheese full of *meat*—that is, full of butter or rich in quality. They speak in high terms of the improvements that have been made in texture, firmness, and solidity; but to see a cheese handsome in appearance, the meat having scarcely any objectionable feature to the eye or finger, yet under the nose a disagreeable odor, is what they cannot well understand. The large exportations of this poor, indifferent, or bad-flavored cheese, more than anything else, breaks prices and does immense damage.

The causes of bad flavor in cheese are various—insufficient and uneven salting; a faulty separation of the whey from the curds before going to press and while pressing; putting the curds to press too hot; high heat and a rapid manipulation of the curds, getting them in press before the proper chemical changes have been effected; but the chief causes of bad flavor in well-manufactured cheese, as I saw it abroad, is, in my opinion, due to bad milk, bad rennet, and bad curing of the cheese. I am satisfied that the cool, even climate in England, and the excellent condition of the milk, together with the uniform temperature of their curing-rooms, enable them to succeed where we often fail. We have a hot-bed climate to contend with, and milk is often spoiled when it reaches the factory. If our dairy farmers would only look upon this matter in its proper light, instead of laying all the blame of bad-flavored cheese upon the manufacturer, there would be some hope of improvement. They send to the factory tainted milk and demand from it a perfect cheese. They impose upon the manufacturer conditions which no skill has yet been able to surmount. High skill and great experience in manipulating milk, together with favorable weather, and the putting the cheese in market just at the right moment, may enable the manufacturer to counteract in part the faults of tainted milk; but with intensely hot weather, and under unfavorable circumstances, it is beyond his art. Bad rennet and tainted milk are prominent causes of the early decay of our cheese.

We are told that American cheese will decay early. I have seen American cheese in England, more than a year old, perfect in flavor and in the best preservation, but it was not made in hot weather. The cheese made in July this year, 1866, and sent to England was all of it, more or less, of bad flavor. The complaint was universal, and against some of the most noted factories in America. We must look upon these things from the practical side. I will not deceive the dairymen of America with a fine-spun theory. We have been greatly led astray in regard to this matter of flavor—led to believe that the people of the Old World had discovered some wonderful process which would insure a perfect cheese under all conditions of the milk; but I found the leading feature of their success was in cleanliness and an untainted condition of the milk.

It is well known that milk not divested of its animalod or, and closely confined, in hot weather, soon becomes putrid. Cheese manufacturers tell me that milk often comes to the factory having a most fetid and sickening odor. In extremely hot weather, when cows have been exercised or unduly excited, the milk is often of a rank odor as soon as drawn. The practice of putting warm milk in tight cans and conveying it a long distance to the factory is objectionable, especially in hot weather. Here is the commencement of bad flavor The good milk is inoculated with putrid matter, which shows itself sooner or later, and carries with it decay like any other decomposition. Some plan should be adopted for cooling the milk, or exposing it so that the animal odor may pass off, especially in hot, sultry weather. I feel certain, from my observations both here and abroad, that this is a leading cause of bad flavor, and hence the practice of the Cheddar dairymen in getting rid of the whey as early as possible, and the exposure of the curd a long time to the atmosphere, is founded upon philosophical principles.

It is important to the dairy interest of America that a reputation be maintained for producing the finest flavored and best cheese made in the world, and, under our improved system of manufacture, with proper care as to the purity of milk, this will be of easy accomplishment.

Again, the cheese-producing sections of the Union are being developed so rapidly that competition every year must be greater and greater. Every factory should now establish a reputation for "extra fine goods." They should keep the best manufacturers in the country. Make it an inducement for them to stay with you. High skill and experience command ample remuneration the world over. Old and established factories can afford to pay for it, rather than let new districts pick off their best cheese-makers. The London dealers complain that there is too little probability of factories sending forward a uniform brand of prime cheese year after year. They want a brand that can be relied upon, and when they find such, will pay an extra price for it. The curing-rooms ought to be arranged so that the temperature may be controlled. The curing-rooms of England have walls of stone or hollow brick. The climate is cooler, more moist, and less variable, than ours. These facts ought to afford suggestions in the construction of our curing-houses. There is another way in which flavor is lost: the shipment of cheese in hot weather, to lie in New York until heated through and through, and then stowing away in the vessel with cargoes of grain, oil-cake, or some other freight from which taints are absorbed. Much of our nice cheese is injured in this way. In Bristol, Bath, London, Chester, Liverpool, Manchester—in fact, all over England, the commercial storehouses for cheese are well constructed for the purpose of preserving flavor. They have stone floors, are cool, and well ventilated. Cheese that comes in bad condition is often taken out of the boxes, or the covers removed, and then laid upon the floor to cool.

The fine compact texture of English cheese, in my opinion, results, in a great measure, from their process of expelling the whey, grinding in the curd-mill, salting, and pressing. I may remark that while porousness is an objection, if the texture is not of a *honey-comb* character, but will fill the trier with a tolerably

compact mass, dealers do not urge a reduction of price, if the flavor and quality are perfect. Extreme porosity shows a defect in manufacture, and carries with it the impression that the cheese will sooner go to decay, and is therefore dangerous to handle, requiring quick sales.

THE PROSPECTS OF THE ENGLISH MARKET.

In closing, a word may be offered in reference to the prospect of future exportation and prices. The English are a great cheese-eating people. We have no conception of the extent to which this food enters into general consumption. Those who can afford to eat a good article purchase the best, and the poor take up with that which is inferior and bad. I have seen tons and tons of the most worthless stuff, apparently fit only for the pigs, in the shops and public markets, and it had a rapid sale. The cutters are extremely expert. They use a thin circular knife, like a half moon, having an upright handle springing from the centre, and with this they cut the cheese upon the counter. They also use a fine wire, with handles at each end, for splitting a large cheese. I have been surprised at the accuracy with which they will cut the different weights. The crumbs are laid on one side, to be used for balancing the scales. There is an immense demand for inferior or low-priced cheese. If we could manufacture cheese so as to sell on the counter at *4d.* to *6d.* per pound, I think they would take our whole product.

Cheese does not come upon the table with pastry, as with us, but is brought on as a separate and last course. A half or a quarter of a cheese, placed upon a silver dish, with a clean, white napkin under it, is set upon the table, and cut as desired.

I think there must be a good foreign demand for American cheese for some years to come. The production has been cut off in the northern districts of England. The cattle plague has been terrible in its ravages through this section. In Cheshire, and the adjoining counties, the losses have been fearful. The Cheshire people feel very melancholy, and many of the farmers are unable to pay their rents. Some of them are trying sheep-farming, but with indifferent results. They have been long a dairy people, and understand the management of cows. I am convinced they will go back to dairy-farming when the cattle plague shall be effectually eradicated—and that appears now to be almost accomplished—but they will hardly get established again for a year or two. They will not abandon dairying till we can furnish cheese so cheaply as to drive them from the market. The cost of transportation and the high prices of labor, and heavy taxation, are against the production of a cheap cheese on this side, at least in the older States. Holland, too, enters into competition with us. She is now shipping to England 80,000,000 pounds of cheese per annum. Last year (1865) the quantity imported was nearly 73,000,000 pounds. The passage can be made in a day, and the cost of exportation is a mere trifle. Their cheese is very good, but not equal to ours; but they are improving every year in quality. They make three styles of cheese, which are popular among the poorer classes. The Edams and Middlebaes are round, like a cannon-ball, and weigh from 6 to 12 pounds. The Goudars are a small, flat cheese, of about 20 pounds weight. The agricultural laborers like Edams, as they can take a cheese into the field and cut it without waste. These cheeses sell at from 8 to 10 shillings per hundred weight, below American. There is less difference between the Derby Goudar and the American, the former often selling within four shillings of the price of ours.

Our future successes will depend upon our making fine cheese, and getting it to market at cheap rates. Something might be done in opening up new markets. The English export cheese to Australia, the Cape of Good Hope, Brazil, and various other points.

Something should be done by the cheese-makers and shippers in the way of regulating exportations. If we could give England a steady supply, without

pushing forward an immense quantity to clog the market, prices would be maintained, and greater profits realized.

The following table gives the number of packages of cheese shipped from New York to Liverpool, from May, 1862, to September, 1866, made up so that the comparative weekly shipments of the different years may be seen at a glance:

Weekly exports of cheese from New York to Liverpool.

Week ending—	1862.	Packages.	1863.	Packages.	1864.	Packages.
May 9	2,120		3,692		2,261	
16	857		1,942		1,539	
23	1,726		9,364		1,323	
30	1,262	5,965	4,446	19,444	3,268	8,391
June 6	1,643		3,040		4,374	
13	3,260		12,174		6,897	
20	6,362		8,744		5,232	
27	7,756	19,041	17,456	41,414	10,090	26,593
July 4	7,107		22,896		24,090	
11	13,441		17,032		29,886	
18	6,961		29,561		47,944	
25	27,483	54,992	19,153	88,642	33,103	135,023
August 1	35,195		16,316		38,170	
8	....		22,024		20,447	
15	5,485		27,378		16,669	
22	37,309		13,342		22,817	
29	24,449	102,438	11,650	90,710	18,211	116,314
September 5	30,315		11,068		15,396	
12	19,255		16,540		14,544	
19	24,442		19,816		19,457	
26	14,130	88,142	18,670	66,094	24,293	73,690
October 3	8,146		18,582		15,250	
10	24,203		31,104		18,805	
17	15,038		21,792		12,406	
24	18,866		38,714		20,653	
31	11,558	69,811	26,082	136,274	25,542	92,656
November 7	24,302		22,818		24,674	
14	24,196		17,706		23,700	
21	13,705		10,110		15,369	
28	18,840	73,043	20,115	70,749	24,921	88,664
December 5	938		12,485		11,794	
12	8,450		12,787		8,496	
19	8,329		10,268		11,919	
26	9,843	27,560	5,533	41,073	9,901	42,110
	1863.		1864.		1865.	
January 2	12,141		5,971		2,973	
9	....		11,963		8,623	
16	3,475		2,216		20,081	
23	7,296		2,632		19,156	
30	14,122	37,034	7,834	30,616	2,685	53,520
February 6	886		6,423		4,851	
13	9,587		10,834		16,069	
20	1,295		4,813		5,689	
27	1,798	13,566	16,479	38,549	15,658	42,267
March 5	929		5,583		2,718	
12	4,164		770		894	
19	3,428		13,202		13,901	
26	1,454	9,975	7,558	27,113	2,770	20,283
April 2	4,166		2,987		2,213	
9	4,348		13,470		4,412	
16	11,762		5,072		4,199	
23	2,742		2,037		3,745	
30	3,842	26,860	2,886	26,432	976	16,545
Total	....	528,427	....	677,110	....	716,256

Weekly exports of cheese from New York to Liverpool—Continued.

Week ending—	1865.	Packages.	1866.	Packages.		
May 9	2,278		927			
16	4,404		656			
23	253		1,170			
30	214	7,149	4,869	7,622		
June 6	3,861		2,614			
13	6,091		6,168			
20	20,714		11,375			
27	11,751	42,417	14,180	34,337		
July 4	36,345		20,994			
11	16,391		21,447			
18	35,097		27,875			
25	25,314	113,147	30,423	100,739		
August 1	30,334		17,068			
8	21,769		11,939			
15	27,476		23,882			
22	25,367		28,138			
29	51,466	156,412	21,795	102,822		
September 5	27,383					
12	27,643					
19	20,139					
26	14,046	89,211				
October 3	1,586					
10	2,335					
17	4,745					
24	1,598					
31	4,643	14,907				
November 7	7,168					
14	5,812					
21	10,307					
28	11,889	35,176				
December 5	4,121					
12	9,347					
19	4,038					
26	1,926	19,432				
	1866.		1867.			
January 2	8,274					
9	1,531					
16	1,117					
23	1,395					
30	839	13,156				
February 6	4,171					
13	5,530					
20	470					
27	340	10,511				
March 5	142					
12						
19	302					
26	269	713				
April 2	493					
9	619					
16	3,660					
23	1,142					
30	362	6,276				
Total		510,507		245,520*		
				321,125†		

Shipments of cheese to London from May 1 to August 31, 1865: 21,000 boxes; 1866, 37,000 boxes.

* Total from May 1, 1866, to September 1, 1866.
† Total during the same time, 1865.

In the foregoing table the average weight of the packages may be estimated at about 70 pounds each. The following table gives the quantity of cheese shipped from New York to Liverpool, from May, 1865, to December 20, 1866, reduced to 100 pound packages, with the average weekly price in shillings (English) at which American cheese sold in London. The tables are valuable in showing how prices are influenced by excessive shipments at any one time:

Shipments of cheese from New York to England, with prices in London.

1865-'66.					1866-'67.				
Week ending—	Boxes.	100 lbs.	Price in London.		Week ending—	Boxes.	100 lbs.	Price in London.	
1865.			1865.	*Shillings.*	1866.			1866.	*Shillings.*
June 6	3	45	June 22	64 to 68	June 5	3	218	June 21	76 to 82
13	3	850	29	64 to 66	12	3	393	28	76 to 82
20	9	703	July 6	64 to 66	19	4	457	July 5	76 to 80
27	8	219	13	56 to 62	26	7	649	12	74 to 78
July 4	20	158	20	60 to 62	July 3	10	272	19	72 to 76
11	14	607	27	60 to 62	10	12	506	26	70 to 74
18	18	67	August 3	58 to 62	17	16	299	August 2	70 to 74
25	24	544	10	58 to 62	24	16	234	9	70 to 74
August 1	20	93	17	56 to 60	31	10	627	16	70 to 72
8	9	809	24	58 to 62	August 7	11	527	23	70 to 72
15	18	278	31	56 to 60	14	13	313	30	70 to 72
22	30	779	Sept. 7	58 to 60	21	12	983	Sept. 6	68 to 70
29	26	998	14	58 to 60	28	16	466	13	66 to 70
September 5	17	546	21	56 to 62	Sept. 4	17	374	20	66 to 70
12	12	342	28	56 to 62	11	17	126	27	64 to 70
19	16	531	October 5	56 to 62	18	4	914	Oct. 4	62 to 68
26	4	486	12	56 to 62	25	7	716	11	62 to 68
October 3	4	486	19	60 to 63	Oct. 2	15	82	18	62 to 66
10	2	325	26	60 to 63	9	16	391	25	60 to 64
17	2	201	Nov. 2	60 to 63	16	10	787	Nov. 1	60 to 64
24	6	596	9	60 to 66	23	19	705	8	60 to 64
31	3	838	16	65 to 70	30	8	261	15	60 to 64
November 7	4	175	23	65 to 70	Nov. 6	8	154	22	60 to 64
14	6	10	30	65 to 70	13	11	660	29	60 to 64
21	11	636	Dec. 7	65 to 70	20	8	858	Dec. 6	62 to 66
28	7	361	14	65 to 70	27	10	847	13	66 to 68
December 5	4	640	21	65 to 70	Dec. 4	11	551	20	66 to 68
12	6	329	28	65 to 70	11	13	506	27	66 to 68
19	5	683			18	10	981		
26	6	81	1866.		25	6	413		
			January 4	66 to 70				......	......
1866.			11	68 to 70	1867.			......	......
January 2	5	683	18	68 to 70	Jan. 1	6	413	......	......
9	4	49	25	68 to 72	8	18	158	......	......
16	2	996	February 1	68 to 72	15	......	......	......	......
23	1	352	8	68 to 74	22	......	......	......	......
30	1	983	15	68 to 74	29	......	......	......	......
February 6	5	553	22	74 to 78	Feb. 5	......	......	......	......
13	3	146	March 1	74 to 80	12	......	......	......	......
20	2	747	8	74 to 80	19	......	......	......	......
27	......	407	15	74 to 80	26	......	......	......	......
March 6	......	580	22	80 to 84	March 5	......	......	......	......
13	......	865	29	80 to 84	12	......	......	......	......
20	......	124	April 5	78 to 82	19	......	......	......	......
27	2	157	12	78 to 82	26	......	......	......	......
April 3	1	133	19	78 to 80	April 2	......	......	......	......
10	1	706	26	78 to 80	9	......	......	......	......
17	......	460	May 3	80 to 81	16	......	......	......	......
24	......	168	10	80 to 81	23	......	......	......	......
May 1	......	906	17	80 to 82	30	......	......	......	......
8	......	396	24	80 to 82	May 7	......	......	......	......
15	1	871	31	73 to 76	14	......	......	......	......
22	......	563	June 7	73 to 76	21	......	......	......	......
29	2	515	14	76 to 82	28	......	......	......	......

THE HOG AND ITS PRODUCTS.

BY CHARLES CIST, CINCINNATI, OHIO.

HOG raising has always been a profitable, and, therefore, a favorite department of farming in what was formerly called the West, but which now constitutes the great centre, as respects population, of our rapidly expanding republic. The rich harvests, to be had simply for the gathering, yielded by the oak, beech, hickory, and other trees of our forests, popularly termed mast, formed to a great extent, for many years, fattening food for swine. The roots in the woods, with the natural grasses, supplied subsistence during the spring and summer months, so that the sole expense to the farmer, in raising hogs, was the feeding of those too young for market, and of those reserved for stock and for increase, at the cost of the Indian corn necessary for their winter sustenance. In early days, and before the introduction of railways, this cereal would not repay the expense of transportation to market, and, therefore, hardly entered into the consideration of what it cost to raise hogs. In fact, taking into view the prolific character of the animal, and the small amount of labor and expense involved in its care and cure, it was the general impression in the West that it cost nothing for a man to make his own pork; and for a long time vast quantities of slaughtered hogs were sold in that region at prices ranging from seventy-five cents to one dollar per hundred weight, and considered sufficiently remunerative at these rates.

The writer of this sketch has seen in the southern portion of Illinois, and within twenty-five miles of land carriage to the Ohio, immense quantities of Indian corn offered at six cents per bushel; yet at this low figure the grain would not bear transportation to the river. The farmer, unless in the neighborhood of a distillery, was compelled to feed his crop to his cattle or his hogs. Even at a much later date, between the scarcity of timber for fuel and the low price of corn, large quantities of the latter article have furnished fuel in the prairie region of the State referred to.

As the cultivation of the country opened, and the wood ranges became more restricted, it was found that it paid better, while it was more convenient, to feed the hogs on corn than to turn them out to the woods, as they grew faster and increased more rapidly in fat as well as in flesh, while the quality, both of meat and lard, was thereby greatly enhanced in value. At this period, for want of good roads, grain to a limited extent only was sold to the whiskey distillers, its low price not permitting it to be carried by wagons to the distilleries, unless from short distances.

Under these circumstances, pork-packers commenced at various points in the West for the supply of the eastern markets, while the rapid increase of hogs kept pace with the corresponding improvement of the western country and the enlargement of its corn crops.

Then came the era of railroads. It was at once seen that hogs could be delivered at market points, either east or west, at less expense, in shorter time and in better condition, than they had hitherto been taken by droves. There was also no giving out of the hogs on the route. The natural result was to give a new impulse to the raising of swine; and from that period the hog has become one of the most important staples of the country.

The history of the hog crop, and its various manufactures and products, is so intimately connected with the growth and progress of the corn crop, that a knowledge of the yield of our great cereal, as far back as it can be ascertained, may perhaps be necessary to a full comprehension of the subject; but as I do not

wish to encumber this article with what may be dispensed with, I shall not, in this respect, go back further than the year 1840.

The corn crops for the years 1840–'50–'60, with the exports of the year corresponding, were as follows:

		Exports.
Crop of 1840	377, 537, 835 bushels.	1, 174, 279 bushels.
Crop of 1850	592, 071, 104 bushels.	6, 595, 092 bushels.
Crop of 1860	838, 772, 417 bushels.	15, 448, 507 bushels.

Even in the great famine year in Ireland—that of 1847—when liberal supplies of food were contributed as a gift by the American people, the exports of corn and corn-meal amounted only to 21,272,815 bushels. Prior to 1850, the exports of corn never made up the half of one per cent. of the corn crop of a given year, and has, as an average, never reached two per cent. for the period since, nor is it likely to exceed that proportion for years to come.

It is, therefore, evident that, as in past years the foreign consumption of corn was absolutely insignificant, so it will probably be in the future; and that we must depend on the home market and stock and stock-feeding for the consumption of this invaluable grain. Let us, then, turn to survey the steady growth and increasing importance of the hog market.

The following figures exhibit the extent of hog-packing in the West, as far as can be ascertained, for a series of years:

Years.	No. of hogs.	Years.	No. of hogs.
1844	1, 079, 062	1857	1, 818, 468
1845	781, 372	1858	2, 210, 778
1846	1, 087, 862	1859	2, 465, 552
1850	1, 652, 220	1860	2, 350, 822
1851	1, 332, 847	1861	2, 155, 702
1852	1, 182, 846	1862	2, 893, 666
1853	2, 201, 116	1863	4, 069, 520
1854	2, 534, 770	1864	2, 261, 105
1855	2, 124, 404	1865	2, 451, 619
1856	2, 489, 502	1866	1, 683, 474

The packing of 1867 will be about 2,700,000 hogs. The heavy operations in this line for 1862 and 1863 grew out of the army demand for provisions consequent upon the war during those years.

Let us now examine the pork-packing of Cincinnati. The total number of hogs packed at that place, during the last thirty years, was as follows:

Years.	No. of hogs.	Years.	No. of hogs.
1833	85, 000	1850	393, 000
1834	123, 000	1851	334, 000
1835	162, 000	1852	352, 000
1836	123, 000	1853	360, 000
1837	103, 000	1854	421, 000
1838	182, 000	1855	357, 788
1839	190, 000	1856	405, 396
1840	95, 000	1857	344, 572
1841	160, 000	1858	446, 677
1842	220, 000	1859	382, 826
1843	250, 000	1860	434, 499
1844	240, 000	1861	433, 799
1845	196, 000	1862	474, 767
1846	205, 000	1863	608, 457
1847	250, 000	1864	370, 623
1848	475, 000	1865	350, 600
1849	410, 000	1866	354, 079

These dates refer to the years in which the business closed—the season beginning in November, and ending usually in March. The hog crop of 1867 will approximate in numbers 480,000.

The pork-packing of Cincinnati constitutes 80 per cent. of the whole packing of Ohio. The number of hogs put up through the West, it will be seen, varies greatly in different years. This does not result so much from the plenty or scarcity in certain years, for the annual increase is the same. But if an unexpected or temporary demand springs up, and higher prices rule, great numbers of hogs of inferior size and weight are rushed to market, and increase the number packed, without a corresponding improvement in the quantity or quality of the pork. This is especially true as respects packing points contiguous to new settlements in the West.

The average weight of hogs and yield of lard for the last and some previous seasons, in the Cincinnati packing, were as follows:

Years.	Average weight.	Yield of lard.
1860	189 pounds.	23 pounds.
1861	221 pounds.	29 pounds.
1862	225 pounds.	29 pounds.
1863	203 pounds.	26 pounds.
1864	189 pounds.	23 pounds.
1865	204 pounds.	24 pounds.
1866	239 pounds.	33 pounds.

It would seem by this table, contrary to the general opinion, that the weight of the hog and the weight of the lard correspond to each other. It would seem, also, by this, that corn-feeding, up to a certain point, contributes to the growth of the animal, and beyond that, to the production of fat, the hog not taking on fat until after a certain stage of growth.

The average prices of hogs, for the last fourteen years, in the market of Cincinnati, were as follows:

	Per 100 pounds.		Per 100 pounds
1854	$4 45	1861	$5 97
1855	5 75	1862	3 28
1856	6 05	1863	4 45
1857	6 24	1864	7 00
1858	5 17	1865	14 62
1859	6 59	1866	11 97
1860	6 21	1867	6 95

Cincinnati packs more pork than any place in the United States, or even in Europe—Chicago excepted—and this exception only holds good during the last three years for the number of hogs, and not the quantity of pork, packed. Cincinnati is the centre of the finest hog-raising region in the world—the States of Ohio, Kentucky, and Indiana—where great pains have been taken for a long series of years to improve the breeds of hogs, and where they have been made to yield unprecedented weights.

As examples of extraordinary weight in hogs cut up in the latter city the following was given by the packers to the press, in 1857:

No. of hogs.	Net weight.	Average per hog.	No. of hogs.	Net weight.	Average per hog.
3	2,031	710	320	104,000	325
5	3,200	640	657	200,355	305
7	5,040	720			
22	8,866	403	1,116	361,846	324
50	18,750	375			
52	19,604	377			

Of these, one litter of nine weighed respectively 316, 444, 454, 452, 456, 516, 526, and 532. These averages, great as they are, have since been largely exceeded, as follows:

No. of hogs.	Net weight.	Average weight.	No. of hogs.	Net weight.	Average weight.
11	6,732	612	200	71,800	359
20	15,452	772	346	139,092	402
30	15,180	506	400	150,000	375
35	15,785	451			
35	15,712	449	1,227	488,505	398
43	15,738	366			
107	43,014	402			

The last ten lots, for extraordinary weight, taking quantity into account, have never been equalled, and the lot of twenty, raised and fed for market in our county, has certainly no parallel in the wide world, none of the hogs exceeding nineteen months in age, and generally running from fifteen to sixteen months old.

The season of pork-packing commences about the 10th of November, varying a few days with the character of the weather.

In a few cases, where the farmer owns large numbers, individuals have driven as many as one thousand head into their fields for fattening; and in some instances the hogs are taken by the owner to the packer direct; but, generally, they are bought up by the drover in lots of one hundred to three hundred head. The hogs are driven into pens adjacent to the slaughter-houses, and when sold to the packer are removed to the smaller pens of the slaughterers, where they are crowded as thick as they can stand, and a man walks over the drove knocking them successively upon the head with a two-pointed hammer, adapted to the purpose. They are then dragged out by hooks into the sticking room, where their throats are cut, the blood passing through a drain or sewer below, adjacent to the sticking room and the scalding troughs, which are heated by steam, each of which is of one thousand gallons' capacity. After being scalded, the hogs are tossed by machinery upon a long bench, as many persons getting to work upon a hog as can stand around it. One cleans out the ears, others pull off the bristles and hair, others again scrape the carcass. This must all be done while the hog is reeking with steam. The bristles and hair are separated, the latter put away to supply curled hair for the eastern markets, the bristles sold to those who dress them for the brush makers. After these operations the hind legs are stretched open with a stick called a gambrel, and the hog is borne off by three men, two of whom carry the front part on their crossed hands, and the other seizes the gambrel. The hog thus carried to the proper place, is slung to a hook which suspends him above the floor. Here the carcass falls into the hands of the gutter, who tears out the inside, stripping at the rate of three to the minute.

The slaughter-houses of Cincinnati, fifteen in number, are in the outskirts of the city, and fifty by one hundred and thirty feet each in extent, the frames being boarded up with movable lattice-work at the sides, which are kept open to admit air, at the ordinary temperature, and shut up during the intense cold which occasionally attends the packing season, in order that hogs shall not be frozen so stiff that they cannot be cut up to advantage. These establishments employ, in some instances, as many as one hundred hands, selected for this business, which requires a degree of strength and activity that always commands high wages.

The slaughterers formerly received the gut fat for the whole of the labor thus described, wagoning the hogs more than a mile to the pork-houses, free of expense to the owners. Every year, however, adds to the value of the perquisites, such as the fat, heart, liver, &c., for food, and the hoofs, hair, and other parts, for manufacturing purposes. Six years since, from ten to twenty-five cents per

hog was paid as a bonus for the privilege of killing. During later seasons this premium has been raised to seventy-five cents, and even one dollar.

The hauling of the hogs to the pork-houses from the slaughterers is itself a heavy business, employing fifty of the largest class of wagons, each carrying from sixty to one hundred and ten carcasses as a load. The hogs are taken into the pork-houses from the wagons, and piled up in rows as high as possible. These piles are generally close to the scales; another set of hands carry them to the scales, where they are usually weighed singly, for the advantage of the draught. They are taken hence to the blocks, where the head and feet are struck off with one blow. The hog is then cloven into three parts, separating the ham and shoulder ends from the middle. These are again divided into single hams, shoulders, and sides. The leaf lard is then torn out, and every piece distributed with the exactness of machinery, and with inconceivable rapidity, to its appropriate pile. The tender-loins, usually two pounds to the hog, and the spare-ribs, to the extent in which they are not left in the side meat, afford supplies to families, and the neck pieces, with other inferior parts of the carcass, are sold to the manufacturers of sausages, and enter largely into the subsistence of the laboring classes of society.

The hog thus cut up into shoulders, hams, and middlings, or sides, undergoes further trimmings to get the first two articles in proper shape. The size of the hams and shoulders varies with their appropriate markets, and with the price of lard, which, when high, tempts the pork-packer to trim very close, and, indeed, to render at times the entire shoulder into lard. If the pork is intended to be shipped off in bulk, or for the smoke-house, it is piled up in vast masses, covered with fine salt in the proportion of fifty pounds of salt to two hundred weight of meat. If otherwise, the meat is packed away in barrels with coarse and fine salt in due proportions, no more of the latter being employed than the meat will require for immediate absorption, and the coarse salt remaining in the barrel to renew the pickle, whose strength is withdrawn by the meat, in process of time.

The different classes of cured pork, packed in barrels, are made of the different sizes and conditions of hogs, the finest and fattest making clear and mess pork, while the residue is put up into prime pork or bacon. The inspection laws require that clear pork shall be put up of the sides with the ribs out. It takes the largest class of hogs to receive this brand. Mess pork requires all sides with two rumps to the barrel. For prime pork hogs of lighter weight will suffice. Two shoulders, two jowls, and sides enough to fill the barrel, make the contents. Two hundred pounds of meat is required by the inspector, but one hundred and ninety-six pounds, packed here, it is ascertained will weigh out more than the former quantity in the eastern and southern markets. The difference of course results from the amount of pickle taken up by the meat.

The mess pork is used for the commercial marine and the United States navy. This last class, again, is put up somewhat differently by specifications made out for the purpose. The prime is packed for ship use and the southern markets. The clear pork goes out to the cod and mackerel fisheries. New Englanders, in the line of pork, make their purchases of the best.

Bulk pork is that which is intended for immediate use or for smoking. The former description is sent off in flatboats for the Lower Mississippi. The great mass, however, of the bulked meat is sent to the smoke-house, which is usually an appendage of the pork-house, and each of which will cure from one hundred and seventy-five thousand to five hundred thousand pounds at a time. Great pains are taken for this purpose to obtain the best qualities of firewood, hickory, beech, and sugar maple being preferred. Here the bacon, as far as possible, is kept until wanted for shipment, when it is packed in hogsheads containing from eight hundred to nine hundred pounds, the hams, sides, and shoulders being put up separately. The bacon is sold to the iron manufacturing regions of Pennsylvania, Kentucky, and Ohio, to the fisheries of Maryland and Virginia,

and to the coast or Mississippi region above New Orleans. Large quantities are disposed of also to the Atlantic cities for local consumption. Flatboats leave Cincinnati about the first of July, and they all take down more or less bacon for the coast trade. The south in this, as in all general provision business, takes the largest share.

For the purpose of further illustrating the business thus described, let us take the operations of any active season—that, for instance, which has just been brought to a close. There is little doubt that an estimate of four hundred and eighty thousand hogs as this year's packing would not exceed the actual fact, which, with the exception of the packing of 1863, (when the business was stimulated beyond due proportions by the demand for provision for the United States army,) is the largest hog-packing ever known in Cincinnati; of the number thus cut up, the product of the manufactured article would be, in their usual distributive proportions, 180,000 barrels of pork, 25,000,000 pounds of bacon, 16,500,000 pounds of lard.

These are the products thus far of the operations of the pork houses alone; that is to say, the articles thus referred to are put up in these establishments from the hams, shoulders, sides, leaf lard, and a small portion of the jowl—the residue of the carcasses which have been taken to the pork-houses being left to enter elsewhere into other departments of manufacture. The relative proportions of bacon and lard, though graded here to a general average, rest on contingencies. An unexpected demand for or advance in price of lard would greatly reduce the disparity if not invert the proportion of these two articles. A change in the value of pickled pork during the progress of packing would also reduce or increase the proportion of barrelled pork to the bacon and lard.

The lard made here is exported in packages to Havana and the West India islands, where, besides being extensively used, as in the United States, for cooking, it answers the various purposes to which butter is applied in this country. It is shipped to the Atlantic markets also for local use as well as for export, to England and France, either in the shape it leaves this market or in lard oil, large quantities of which are manufactured at the east.

Seven-eighths of the hams and a slight proportion of the shoulders are sugar-cured, and of these nine-tenths are covered with canvas and coated with lime to preserve them from the fly during the summer months. The sugar-curing is thought to improve the flavor of the hams, and undoubtedly operates to protect them from the natural tendency of the salt to harden the flesh unduly, while it subdues the predominant taste of salt.

There is one establishment here, among others of the same kind, which besides putting up hams, &c., extensively, is engaged in extracting the grease from the rest of the hog. Its operations have reached in one season as high as thirty-six thousand hogs. It has seven large circular tanks, six of 15,000 pounds and one of 6,000 pounds capacity. These receive the entire carcass, with the exception of the hams, and the mass is subjected to steam process under a pressure of seventy pounds to the square inch, the effect of which operation is to reduce the whole to one consistence and every bone to powder. The fat is drawn off by cocks, and the residuum, a mere earthy substance, as far as made use of, is taken away for manure. Beside the hogs which reach this factory in entire carcasses, the great mass of heads, ribs, backbones, feet, and other trimmings of the hog, cut up at different pork houses, are subjected to the same process in order to extract every particle of grease. This concern has turned out as much as three million six hundred thousand pounds of lard, five-sixths of which was No. 1. Nothing can surpass the purity and beauty of this lard, which is refined, as well as made, under steam processes. Six hundred hogs per day on an average pass through these tanks.

Beside the hogs packed for market abroad there is an immense consumption of pork supplied to the local markets and meat shops of Cincinnati and to steam-

boats at the landing. This has amounted to as much as fifteen hundred hogs per week for six months of the year, and one sausage establishment has sold as high as three thousand pounds per day.

We are now through with the products of the hog, so far as they relate to food for mankind; and now let us follow on to the manufacture of lard oil, which is accomplished by divesting lard of one of its constituent parts—stearine. There are fifteen lard oil factories here on a scale of more or less importance. The largest of these, whose operations are probably more extensive than any other in the United States, has manufactured heretofore in lard oil and stearine one hundred and fifty thousand pounds monthly during the whole year.

Eleven million pounds of lard were run into lard oil last year, two-sevenths of which aggregate made stearine; the residue, lard oil, or, in other words, twenty-four thousand barrels of lard oil, of forty to forty-two gallons each. The oil is exported to foreign countries and to our Atlantic cities. Much the largest share of this oil is made of inferior lard, the product of hogs fed on mast and still-slop, and the material to a great extent comes from a distance, making up no part of the foregoing tables. Lard oil, beside being sold for what it is, enters largely into the adulteration of sperm oil in our eastern cities, and in France serves to reduce the cost of olive oil. The presence of stearine, which deposits in small portions, may always be detected at the bottom of the bottles.

We now come to the star and opal candles made of the stearine expressed from the lard in the manufacture of lard oil. The stearine is subjected to hydraulic pressure, by which three-eighths is discharged as an impure oleine. This last is employed in the manufacture of soap. Three million pounds of stearine, at least, have been made in one year into star candles and soap in these factories, and they are prepared to make thirty thousand pounds of star candles per day. The star candle resembles spermaceti, consuming its snuff in burning. This the opal cannot do, and is therefore not so popular, yet it is so handsome that the entire product, probably four hundred thousand pounds per annum, is readily sold. An opal candle newly made is so transparent when held up to the light as to exhibit the wick in the centre as plainly and distinctly as if it were passed through a glass tube.

Almost one-half of the stearine, as well as the oils made for illuminating and lubricating purposes and consumed in the manufacture of soaps, is the product of lard rendered from the hogs cut up at Chicago, or at other places, which is not included in the previous tables of Cincinnati hog operations. They are referred to here only to account for the extent of our soap and candle manufactures, which far exceed those of any other city in the United States, if not in the world.

Four per cent. of the stearine goes into refined lard, principally sold to the eastern cities, where it enters into confectioners' use and domestic pastry. Red oil is separated by compression from stearine, which yields fifty per cent. of oil. Nine-tenths of the red oil is employed in the production of soap.

Another description of oil largely in use among the eastern manufacturers is oleine. This is stearine saponified, put under distillation and then pressed, yielding oleine oil as the product.

The remaining product, in the shape of manufacture, to be noticed is glycerine. This article is produced from the waste in the manufacture of star candles, and until within the last eight years was entirely lost. Glycerine is not a sugar, although very sweet to the taste. Lard is placed in strong tanks with water at a temperature of 350 to 400 degrees, where the fatty matters are broken up into fatty acids and glycerine; the latter being specifically the heavier, forms the lower stratum and the acids the upper. These are separated mechanically, and the glycerine subjected to various degrees of purification, according to the purposes for which it is designed. By this process glycerine escapes the unpleasant odor of the article formerly supplied from England, which was made from soap

waste and of necessity contaminated by the fat acids contained in the filthy and rancid grease used in soap-making. It presents the appearance of oil, but is not liable to oxidation, nor will it readily evaporate. It is used internally and externally, and largely for mechanical purposes, and in fact, as in the case of gutta percha, every day new and important uses for it are coming to light. It is an article of recent application to general purposes, having been known and used to but a limited extent for years past, owing to the expensive materials and processes employed in its manufacture. But modern chemistry has brought this valuable substance to light from hitherto hidden recesses, and by increasing the product and diminishing the expense of its production, glycerine will now become a substitute for many articles, which it supersedes to advantage.

It is prescribed by the faculty in place of cod-liver oil, being equally serviceable and more palatable for invalids. It proves a valuable aid in surgical practice and in the treatment of wounds, and is applicable to the relief of burns, rheumatism, sore throat, and ear diseases. It is also the best remedy for the chapping of the lips or the hands, and a specific for sore teats in cows. Its pharmaceutical use as a solvent is superior for general purposes to either alcohol or water. It is an antiseptic, and in its non-liability to ferment, its fattening properties, and for its pleasant taste, is of immense value to the druggist, and consequently to the physician and his patient.

It is used extensively in filling gas meters, where it does not evaporate like alcohol nor freeze like water. It also furnishes perfumers with the best ingredients in hair oil, and as such enters largely into use. Tanners use it to keep leather soft, and it is superior to oil in keeping harness free from cracks. It is better than molasses for making printers' rollers, which it keeps constantly flexible and yielding, and when incorporated with the material of printing paper it obviates the wetting down process and renders the paper soft and pliable for immediate or future use. It also keeps fine-cut tobacco sweet and moist, and is an excellent ingredient in paste blacking and a valuable adjunct to copying ink. Its applicability to these purposes consists chiefly in its property of resisting the drying influence of the atmosphere by which there is scarcely any other known substance less affected.

Hitherto we have been dependent on London druggists for this valuable article, for which so high a price was demanded that it could not be retailed in the United States for less than one dollar and fifty cents per pound. It can now be supplied to the consumer for one-fourth that price, and as we obtain glycerine from lard, while the foreign article is extracted from palm oil, the home product excels the imported in the degree that animal extracts are stronger than the corresponding article obtained from vegetable products.

Glycerine is manufactured at two or three factories here to the extent annually of five hundred thousand pounds and of the value of two hundred thousand dollars.

A brief recapitulation of the various products of the hog, at this point and date, presents the following figures:

Barrels of pork	180,000
Pounds of bacon	25,000,000
No. 1 lard	16,500,000
Gallons of lard oil	600,000
Gallons of red oil	50,000
Gallons of oleine oil	48,400
Pounds of star candles	3,675,000
Pounds of opal candles	254,000
Pounds of bar soap	1,475,000
Pounds of fancy soap, &c.	2,100,000
Pounds of glycerine	600,000
Pounds of stearine	3,150,000

Four hundred and eighty thousand hogs, including seven pounds gut fat to each, exhibit one hundred million pounds carcass weight when dressed. This is distributed as follows:

	Pounds.
180,000 barrels pork, 196 pounds net, is	35,280,000
Bacon	25,000,000
No. 1 or leaf lard	16,260,000
Common lard or grease, for oil, stearine, &c.	6,000,000
Inferior grease, for soap	1,200,000
Evaporation, shrinkage, waste, cracklings, and offal for manure	16,260,000
Total	100,000,000

The value of this depends, of course, greatly on the foreign demand. In 1847 the pork, bacon, lard oil, star candles, &c., exceeded six million of dollars in value. The crop and the manufactured products of 1866 will greatly surpass this amount, reaching to beyond eighteen million of dollars.

The buildings in which the pork is put up are of great extent and capacity, and in every part thoroughly arranged for the business. They generally extend from street to street, so that one set of operations may be carried on without interfering with another. There are thirty-six of these establishments, besides several of minor consequence.

The stranger who visits this city during the packing and especially the forwarding season becomes bewildered in the contemplation of the various and successive processes he has witnessed in following the several stages by which the hog is put into marketable shape, and in surveying the apparently interminable rows of drays which at that period occupy the main avenues to the river in continuous line, going and returning, a mile or more in length, excluding every other use of those streets from daylight till dark. Nor is his wonder lessened when he casts his eye on the innumerable hogsheads of bacon, barrels of pork, and kegs of lard, for which room cannot be found on the pork-house floors, spacious as they are, and which are, therefore, spread over the public landing and block up every space on the sidewalks, the public street, and even adjacent lots otherwise vacant, where they may be found piled three and four tiers high. It may appear remarkable, in considering the facilities for putting up pork which exist at hundreds of places in Illinois, Ohio, Indiana, and Kentucky, in a line more immediately contiguous to the neighborhoods which produce the hogs, with other palpable advantages, that so large a share of this business is engrossed by Cincinnati. It must be observed, however, that the raw material in these operations—the hog—constitutes sixty per cent. of the value when ready for sale, and being always sold for cash, disbursements so heavy are required, in large sums and at a day's notice, that the necessary capital is not readily obtainable elsewhere in the west. Nor, in an article which, in the process of being cured, runs great risks in sudden changes of weather, can the packer protect himself except in a large city, where there are extensive supplies of salt, and any necessary force of coopers or laborers to employ in case of emergency or disappointment in previous arrangements. More than all, the facility of turning to account, in various manufactures or as articles of food in a populous community, what cannot be disposed of to profit elsewhere, renders hogs, to the Cincinnati packer, worth at least five per cent. more than they will command at any other point in the west. Accordingly, there is no point in the packing region where hogs are not sold from twenty-five to forty cents per hundred pounds less than in this market.

As a specimen of the wonderful activity which characterizes all the details of packing, cutting, &c., in this city, it may be stated that two hands in one of our pork houses, in less than thirteen hours, cut up eight hundred and fifty hogs

averaging over two hundred pounds each, two others placing them on the blocks for that purpose. All these hogs were weighed singly, on one pair of scales, in the course of eleven hours. Another hand trimmed the hams—seventeen hundred hams—in Cincinnati style, as fast as they were separated from the carcasses. The hogs were thus cut up and disposed of at the rate of more than one to the minute. A still greater feat has since been performed by two men, under the same circumstances as narrated above, cutting up twelve hundred and forty-seven hogs in fourteen hours. None but a pork packer can fully appreciate this achievement, and few pork packers would believe it was ever accomplished.

The value of these manufacturing operations to Cincinnati consists in the vast amount of labor they require and compensate, and the circumstance that the great mass of that labor furnishes employment to thousands at the very season when their regular avocations cannot be pursued. Thus there are, perhaps, fifteen hundred coopers, in and outside of the city, making lard kegs, pork barrels, and bacon hogsheads; the city coopers being employed at a period when they are not needed on stock barrels and other cooperage, and the country coopers, whose main occupation is farming, during a season when the farms require no labor at their hands. Then there is another large body of hands, also agriculturists at the proper season, who are engaged in getting out staves and heading and cutting hoop poles for the same business. Great quantities of boxes, of various descriptions, are made for packing bacon especially for the English markets. Lard, also, is packed to a great extent in tin boxes or cans, the making of which furnishes occupation to tin-plate workers.

If we take into view, further, that the slaughtering, the wagoning, the pork-house labor, the rendering of lard and grease, and the lard oil, the stearine, and the soap and candle products, bristle and curled hair dressing, and other kindred employments, supply abundant employment to men who in the spring and summer are engaged in the manufacture and hauling of bricks, quarrying and hauling stone, cellar digging and walling, bricklaying, plastering, and street paving, with other employments, which in their very nature cease when winter approaches, we can readily appreciate the importance of a business which supplies labor to probably fifteen thousand individuals, who but for its existence would be earning little or nothing one-third of the year.

I have referred to the remarkable fact, that there was a period in the west when corn would not, in some sections, command six cents per bushel, and in others was of so little value as to be substituted for wood as fuel. Not less extraordinary is the fact, within the knowledge of hundreds now in Cincinnati, that in the early ages of pork packing, say in 1828, there was so little demand for any portion of the hog, other than hams, shoulders, sides and lard, that the heads, spare-ribs, neck pieces, back-bones, &c., were regularly thrown into the Ohio river to get rid of them!

A more distinct impression will be given of the slaughtering and packing of hogs by a statement of these operations, as witnessed by the writer at a recently erected establishment in Cincinnati, which has introduced some novelties and improvements in the business.

Slaughtering requires forty to fifty hands, distributed as follows: One pen boss, to count in and take proper care of the hogs while in the pens; two hands to drive up and fill knocking-down pens; one to knock down; one to stick; one to scald; one to work lever and throw hogs out of the tub; four to scrape off hair; six to shave off remaining particles of hair; two to gambril; one to wash down; one to gut; two to separate the fat from the intestines; one to cleanse the fat from blood, dirt, &c.; two to secure pluck fat and cut pizzle-strings; one to wash out hogs after being gutted; two to dry-shave; two to run off hogs; two to catch off of travelling hooks and run back on slides; one tank-man and helper; one lard drawer; one steam-tub man, and one engineer; being, in this instance, forty-five hands.

There are fifteen slaughtering houses the present season, one of which alone slaughtered sixty thousand hogs.

By the new method of disposing of hogs after they leave the dressing table, the animal is gambrelled and swung off the end of the table, being supported by a hook attached to a grooved roll or sheave, which revolves on the edge of an iron bar, popularly called the railroad. The hog being now suspended by his hind legs, falls into the hands of the gutter, an expert performing the operation of stripping the carcasses at the rate of one hundred and eighty to the hour. The inside of the hog is next thoroughly cleansed of blood by the application of water from a hose-pipe. The dry-shaver next takes him in hand, removing all hair overlooked at the table. By means of the railroad extending through the dry-room, the hog is then run off to any desired point instead of hanging on stationary hooks, as under the old system. Joists are bolted to timbers above, with cleats or rests spiked on the lower face; these joists are suspended in straight lines, and have a uniform space of twenty-five inches, the usual length of the gambrel. The hog is next transferred from the travelling-hook to the rests by means of a lever, having its fulcrum on the rests, the ends of the gambrel-stick being supported by the rests or cleats. The hog is then run forward in a direct line with but little effort, and left hanging until the animal heat is entirely expelled, when he is ready for the block to be cut up into any desired style. The feet and tongues of hogs are put up in spiced pickle and sold at the south. The blood is the only part of the hog which runs to waste. The bristles are plucked from the carcass as it comes from the scalding-tub, separated in color and quality, packed in barrels, and sent to establishments which clean and dress them for market. The hair, after receiving certain treatment, becomes the curled hair used at the east for sofas, mattresses, cushions, &c. The plucks of the hogs are collected by one party, who, by a patented process, subjects them, with all other species of animal offal incidental to slaughter-houses, to hydraulic pressure, thereby expelling all moisture; and after drying them artificially, they are made ready in twenty-four hours for grinding up into manure. This species of fertilizer is packed in barrels, large quantities being shipped to the east.

The heads, gut-fat, and rough trimmings are put into iron tanks, to which steam is applied, the fatty portion of the contents, after eight hours' cooking, being drawn off into casks and sold as head and gut lard.

Cincinnati kettle-rendered lard is exclusively the product of the leaf of the hog; that is, the collection of fat surrounding the kidneys and adhering to the sides, the only legitimate portion fit for culinary purposes.

The hams of late years, with our city packers, are almost invariably sugar-pickled, being placed in tight hogsheads, and pickle, in due proportions of salt, molasses, saltpetre, &c., poured over them. During the process of cure they are frequently overhauled, so as to insure every portion coming under the action of the brine. After remaining in pickle a sufficient period to determine their cure, they are hung in smoke and afterwards covered with canvass to protect them from the fly, and are then packed in tierces ready for market.

The shoulders are almost entirely cured in dry salt, a small share making barrelled meat, rating as prime and prime mess pork, for both of which there is but a limited demand.

The sides of the heavier class of hogs are mostly cut into four or more pieces at the block, and packed in barrels as mess pork.

Shoulders and sides, however, enter more largely into consumption as bacon, the latter designated as rib, clear rib, and clear clear rib having the back-bone sawed out, and clear being free of both back-bone and ribs. The latter two are most in request, and rib bacon is but little called for. The ratio of fully cured products of shoulders, sides, hams, and lard, will bear the following proportions, varied somewhat by the condition of hogs and style of cutting: Shoulders, 15 per cent.; sides, 40; hams, 13; lard, 12; heads, offal, and shrinkage in curing, 20 per cent.

Owing in a great measure to the prevalence of an epidemic called hog cholera, which has been more or less destructive throughout the west, the old method of feeding hogs in large droves has been abandoned, and they are now fattened in comparatively small lots by the farmers, and in season are collected by drivers and marketed usually by railroads.

A statement of the business of one of our manufacturing houses most extensively engaged in the production of lard oil, star and tallow candles, soap, &c., will afford an impressive view of the extent and magnitude of these operations. This firm has, in a single year, made star and tallow candles, soap, lard oil, oleine oil, glycerine, &c., exceeding a value of two million of dollars. They are regularly filling orders, from California and elsewhere, of five thousand to ten thousand boxes each of soap and star candles, the first of sixty pounds and the second of thirty-five pounds to the box. They use up of raw materials, thirty-six hundred barrels of rosin, one thousand tons of soda ash, thirty thousand pounds of candle wick, twenty hundred carboys of sulphuric acid, and five thousand barrels of tallow annually; and their consumption of lard, on an average, equals seven hundred and fifty tierces, three hundred pounds each, per week, for two hundred and eighty days of the year.

The introduction of petroleum, or coal oil, has, of course, greatly checked the use of lard oil, both for lubricating and illuminating purposes, and but for the increasing demand for lard as the basis of stearine and soap oils, as well as for other uses, must finally have effected a marked decrease in the value of the article.

The product of petroleum for the year 1866, added to the stock in market left over from 1865, was 2,850,000 barrels; of this there was consumed at home 1,066,666, and abroad 1,050,000 barrels, leaving a surplus at home and abroad of 773,334 barrels. These 2,116,667 barrels were equal to 84,666,680 gallons. The average price of the coal oil sold in 1866 was forty-one cents per gallon. The corresponding supply of sperm oil was 36,663 barrels, or 1,466,520 gallons, at two dollars and fifty-five cents per gallon, and 108,000 barrels, or 4,320,000 gallons of lard oil, at one dollar and sixty cents per gallon. With the immense and yearly increasing supply, and the low figures at which it sells, and the great superiority, either as a lubricator or illuminator, of petroleum over these competitive articles, the sale of lard oil and whale oil must soon be confined to other and greatly limited purposes.

By a recent experiment it was ascertained that one pint of coal oil, costing six cents, fed one coal-oil lamp during six evenings, or for the space of twenty-eight hours, averaging four hours and forty minutes to the evening; two lard-oil lamps having been required for the same service. The cost of the lard oil was four cents per evening, that of the coal oil two cents. The advantage of coal oil in yielding light over sperm oil is no doubt equally great.

The census of 1860, affording the latest table of the number of hogs in the United States, gave it as 33,512,867, exhibiting an annual increase of about 300,000 during the previous decade. As no use can be made of the hog but for food, and the surplus is annually consumed for that purpose, the annual increase is very regular, and the number at the close of 1866 may be safely put down at 35,500,000. This is nearly as many as can be found in the whole of Europe. In the western States, according to the census of 1860, there are one hundred and thirty-four hogs to every one hundred of population; in the southern States the proportion is one hundred and sixty-three to every one hundred. Notwithstanding this disparity, the South not only consumes her increase of hogs, but is the largest purchaser which the West finds, at home or abroad, for her large surplus. To solve this problem is not only out of my power, but I have never found any person who could supply a plausible solution of it. To heighten the difficulty, it must be recollected that the negro in his heretofore slave condition had his meat, as well as other food, measured or weighed out to him daily, and of course the ration was far more likely to fall short of what he could consume than to exceed it.

PISCICULTURE WITH REFERENCE TO AMERICAN WATERS.

BY THEODORE GILL, M. D.

PISCICULTURE AMONG THE ANCIENTS.

FISHES, from the earliest ages, have been objects of interest to the philosopher as well as to the people at large, and the mystery in which their habits are enshrouded by the element in which they live has rather enhanced the curiosity excited by their appearance, and has lent much of the zest which the sportsman experiences in pursuit of them. As is usual, too, with respect to subjects which are difficult of observation, fable has lent its charms to invest these beings with marvellous properties, both of body and intelligence, and truth and fiction are so mingled in the accounts given of their habits by the ancients, that the two are, in some cases, separable with great difficulty. Yet the ancients were, in truth, perhaps, better acquainted than the moderns with the habits of some fishes; for never has the taste for fish been carried to such extreme, and never has it been gratified at such expense, as in ancient Rome. The exorbitant prices commanded by fishes which fulfilled certain arbitrary requisites as to condition and size, naturally directed to them much attention, and fish ponds were formed at enormous cost, while the fishes destined for them were sought for in distant ports, and transported to the ponds or preserves of Roman senators and noblemen, to be fattened for the table and to propagate their race, and afford a supply of the desired luxury in the finest condition. Pisciculture was indeed carried on in those days with zeal and success, and much could be learned from the experience of that age; but zealous and skilful as were the ancients, the device of transplanting, or artificially fecundating, the ova, and rearing the fishes from the egg, seems to have been totally unknown to them.

PISCICULTURE AND SPAWN COLLECTING IN CHINA.

Fish-raising, for economical as well as ornamental purposes, has been practiced from time immemorial by the Chinese, and the gold fish, so familiar as an ornament of the parlor or drawing-room, will be recalled as one of those species for which we are indebted to that singular people. Sports or monstrosities of the gold fish have been cultivated with great success by them, almost innumerable varieties having been obtained, and eighty-nine have been illustrated by a French naturalist, M. de Savigny, in a special work entitled "*Histoire Naturelle des Dorades de la Chine.*" These rarities well show how much nature can be controlled by man, as forms destitute of certain fins, and possessing others double or even more hypertrophied, have been secured and perpetuated. The experience of a people which have succeeded in such efforts would be interesting as well as instructive, but that hitherto furnished has been too vague. They, however, avail themselves of the fry which have just escaped from the egg, as well as the eggs themselves, and carry on a considerable commerce in both. The most recent writer, Mr. R. Dabry, French consul at Han-Kow, has published some observations on the manner of securing the newly hatched fishes, prefatory to a list of species, of which a translation is here offered. It contains information which may at least prove entertaining, though it is not sufficiently

definite, and is evidently too generalized to be very reliable; but with these precautions, its publication may be of use. The remarks relate principally to the fishes of the Yang-tsze Kiang basin:

"The fishes spawn in the spring, from the fifth of May to the first of June. Each species has its own hole, in which it deposits its eggs. These holes vary in form as well as size, and are from 1.67 to 6.67 metres (about five to twenty-one feet) below the surface of the water. To find these holes, fishermen of a peculiar class (*Me-yu-ty-jin*, that is 'men who touch the fish') dive and seek, by feeling with the hand, for the spots in which the greatest warmth prevails.* When such a spot is found, the fry are taken by means of a small net, with very fine meshes, and which is attached to a bamboo hoop, the net being hauled to the surface by means of a string by an assistant. The fry of several species are readily distinguishable. There are others, such as the *Houany-yu*, *Kan-yu-ky-yu*, *Yong-yu*, *Tsin-yu*, which cannot be identified till the fish has attained a certain size.

"When the fry have been taken from the water they are as soon as possible put into copper vessels, which are then covered with thin cloth. These vessels should be three-quarters filled with water, which is changed three times a day—morning, noon, and evening. While this is being done, a very fine gauze cover is used to prevent the little fishes from escaping from the vessel. Exposure to the sun is to be avoided; the vessel should not be disturbed, and as soon as any of the fishes die, they should be removed.

"The daily food is supplied by the yolks of eggs, which are boiled and mashed up fine. The fishermen advise that the vessel should not be exposed to storms or rain.

"The fish can in this way be kept for two or three months.

"When it is desired to stock a body of water, it is only necessary to place the little fishes in weedy situations, or it will even suffice to throw them in the middle of the water, without any precaution. The fry of each species of fish wanders under the guidance of the mother, who does not abandon her offspring till they are quite large. The fry of the '*Kia-you*' ('home or domestic fish') does not wander."

We have also accounts of European travellers, extending as far back as the first half of the last century, from which it would appear that the Chinese had long been accustomed to secure the eggs of various fishes, and that they raised the fishes directly from the egg. Duhalde, a Jesuit father, who published an account of his travels in the year 1735, made known that not far from the town of Kieou-king-fou, in the river Yang-tsze Kiang, very numerous boats came from all quarters in the spring to obtain the spawn of fishes. To secure this spawn, the men devoted to the search for it partially dam the river at certain places, for a distance of nine or ten leagues, with mats and hurdles, leaving only sufficient space for the passage of boats. The spawn is arrested in its descent by these barriers, and thus secured. Much of this spawn is said to be at first undistinguishable by the unaccustomed eye, but those engaged in the fishery readily recognize it, and placing the water containing it in jars, offer it for sale. As may be supposed, it is not certain in all cases what particular fishes the ova thus obtained may give birth to.

RAPID GROWTH OF CHINESE FISHES.

The old traveler, Huc, likewise gives an account of pisciculture as practiced in the southern provinces supplied by Canton, and he gives a very lively narrative of the rapid growth of the fishes raised, and naively remarks that the rapidity

* I thus interpret the vague expression, "les endroits dans lesquels se développe un peu de chaleur."

of their development is *incredible;* and the following abstract will demonstrate the truth of the statement:

"A month after the fishes are hatched they are full of vigor, and this is the time to give them food in abundance. Morning and evening the proprietors of the vivaria have their fields mowed, and enormous loads of grass or herbs are taken to the fishes. The fishes ascend to the surface of the water, and dart with wild eagerness on this food, which they playfully devour, with a rumbling noise, reminding one of the noise made by a large number of rabbits feeding—indeed, it might be supposed that they were a large warren of aquatic rabbits. The voracity of these fishes can only be compared to that of silk-worms when about to prepare their cocoons. After having been fed in this manner about fifteen days, they ordinarily attain a weight of two or three pounds, when their growth is arrested." They are then caught and sold. What a pity it is that we do not know to what species this fish belongs, which thus attains its growth in a fortnight, and reaches in that time a weight of two or three pounds! Our ignorance is the more to be deplored, since the fish is said to be of exquisite taste.

After this fish story, we may not linger with the Chinese, but shall return to Europe.

PISCICULTURE IN EUROPE DURING THE MIDDLE AGES.

Pisciculture seems to have been considerably practiced in Europe during the middle ages, and especially by the monks, who relieved the monotony of their seclusion by attention to the agricultural and other useful arts, as well as by literary studies. It has been claimed that some of the most esteemed fishes now abundant in the fresh waters of England were introduced during that period; but such accounts are very problematical, and it is probable that most, if not all, had existed there at least from the dawn of the present geological epoch. However this may be, it is certain that species were introduced into new continental waters, and that the monks laid out ponds and raised therein, in conformity with regular rules, several esteemed fishes, whose habits best suited them for rearing in such preserves. Chief of these were the carp and tench. The pike was also frequently introduced to check the excessive multiplication of the herbivorous species. Artificial fecundation was, however, unknown to the monks, and its discovery is little more than a century old.

DISCOVERY OF ARTIFICIAL FECUNDATION BY JACOBI.

In 1763, Jacobi, a lieutenant in the small principality of Lippe-Detmoldt, first announced, in the pages of the "*Hannover Magazin,*" a periodical published in the town indicated by its title, the results of experiments, conducted for about thirty years, on the artificial fecundation of the salmon and trout, and this memoir, in its entirety or in abstracts, was published in Berlin and Paris, and the discovery directly communicated to several of the prominent naturalists of the day, especially Buffon. Jacobi even received from the English government a pension, in appreciation of the importance of his discovery. Artificial fecundation, soon afterwards practiced on a larger scale at Noterlem, also in the kingdom of Hanover, yielded favorable results. Jacobi having recognized the nature of the sexual relations of the fishes, and that the female, when spawning, was followed by the male, who dropped his milt over the ova of his companion, and thus fertilized them, inferred that nature may be imitated and assisted by man. He therefore took a clean wooden bucket or shallow tub, and emptied into it a pint of clear water. Taking then a female salmon whose ova were mature, he expressed them by a gentle pressure of the hand down the abdomen, and treated a male fish in the same manner, discharging his milt over the ova.

The ova, thus fertilized, were then placed in a box made for the purpose, and which is thus described by Jacobi, as translated by Fry:

"The box may be constructed of any suitable size: for example, eleven feet

long, a foot and a half wide, and six inches high. At one extremity should be left an opening six inches square, covered by a grating of iron or brass wire, the wires not being more than four lines apart. At the other extremity, on the side of the box, should be made a similar opening, six inches wide by four inches high, similarly grated. This one will serve for the escape of the water, the other for its entrance, and the grating will prevent water-rats or any destructive insects from reaching the eggs. The top of the box should be closely shut for the same reason; but a grated opening, similar to the rest, six inches square, may be left to give light to the young fish. This, however, is not absolutely necessary.

"A suitable place should then be chosen for the box near a rivulet, or what is still better, near a pond supplied with running water, from which may be drawn, by a little canal, a stream, say an inch thick, which should be made to pass continually through the gratings and through the box.

"Lastly, the bottom of the box, to the thickness of an inch, should be covered with sand or gravel, and over this should be spread a bed of stones of the size of nuts or acorns; thus will be made a little artificial brook running over a gravelly bottom."

The fecundated eggs are spread "in one of the boxes so placed, and the water of the little rivulet passes over them, care being taken that it does not run with such rapidity as to displace and carry away with it the eggs, for it is necessary they should remain undisturbed between the pebbles."

"Care must be taken to remove, from time to time, the dirt which is carried by the water and deposited on these eggs; this can be done by stirring about the water with a quill feather."

Using such precautions, and profiting by the experience gained in the course of his experiments, Jacobi perfectly succeeded in his attempts, and to him belongs, unquestionably, the merit of first artificially fecundating the eggs of fishes, or at least the first publication of the principles of the art and of the results which would logically flow from it.

ARTIFICIAL FECUNDATION.

In 1768, Spallanzani, in the course of his physiological experiments, successfully practiced artificial fecundation in the case of the frog, an animal of analogous habits. Adanson, the celebrated naturalist and African traveller, was also acquainted with the principles of artificial fecundation, and in a course of public lectures, delivered at the Jardin du Roi in 1772, clearly explained the principles and *modus operandi*.

REDISCOVERY AND PRACTICAL APPLICATION OF ARTIFICIAL FECUNDATION.

The memory of these experiments and results had, however, almost faded from the mind, or remained to few, who from time to time practiced in an unobtrusive manner, or made use of their knowledge as a means of conducting physiological and embryological investigations.* This neglect was due perhaps to the interruption of all peaceful pursuits entailed by the long European wars. The announcement to the French Academy of Sciences of the successful prosecution of artificial fecundation by Rémy and Géhin, two fishermen of the department of Vosges, was even received at first as a new discovery.

Joseph Rémy, a fisherman of La Bresse, an illiterate man, but of observant habits and reflective mind, fearing lest his calling should be interrupted by the

* Among those that experimented in the artificial fecundation of fishes for practical purposes, Mr. John Shaw should be especially enumerated. He successfully practiced artificial fecundation in the case of the salmon, making his experiments in the river Nith, of Scotland, chiefly in the year 1837, and has published an account of the results in a work "on the development and growth of salmon fry."—Edinburgh, 1840.

threatened extinction of the trout, the capture of which afforded him a livelihood, and, like Jacobi, reasoning upon the sexual relations of the fishes, conceived the idea of artificial fecundation. Associating with himself a companion, Antoine Géhin, the two, after long and patient endeavors, enlisted the sympathy and active co-operation of several influential men in their district, and prosecuted the, to them, new art with skill and success. This result excited much interest and remark in their native district; but the fame of it extended but little beyond. At a session of the Academy of Sciences, on the 23d October, 1848, Professor de Quatrefages, a distinguished naturalist, recalling the successful fecundation of the ova of fishes by naturalists for experimental purposes, as well as the discovery by Jacobi, recommended the application of the principles involved to the restocking of depauperated streams, and remarked that in this art were apparent the "indications of an industry quite new, at least for France." This lecture of the great naturalist elicited from the secretary of the "Société d'Emulation des Vosges"—a society which had encouraged the labors of Rémy and Géhin—a communication, of the 2d March, 1849, detailing the success attained by those fishermen. The interest of the Academy was at once secured, and distinguished academicians reported on the results of the new experiments, and recommended the application of this branch of industry, thus fairly developed, to the attention of the French government. All due credit was given to the fishermen for their meritorious labors, for as far as they were concerned, they were true discoverers, having been entirely ignorant of what had been effected before. The public mind and the spirit of the age being then disposed to appreciate the importance of the principle as a means of arresting the rapid deterioration of the fisheries, and alarm having been already excited by such decrease, the government, as well as private individuals, at once availed themselves of it, and artificial fecundation has become a recognized art and branch of industry, not only in France but elsewhere. Improvements in manipulation and treatment have been derived, and much enthusiasm has been enlisted.

NATURE AND OBJECTS OF PISCICULTURE.

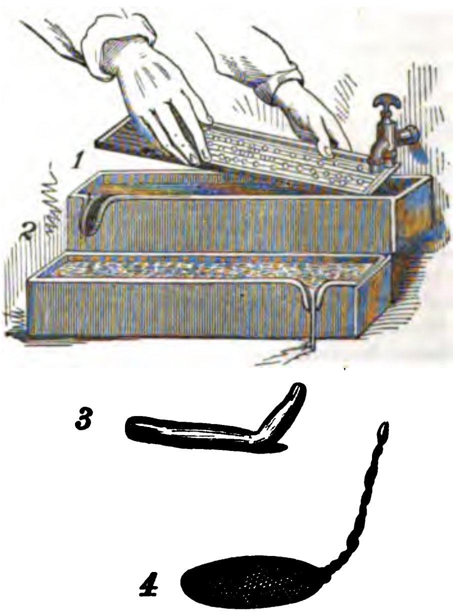
Lest some misapprehension may prevail respecting the objects and aims of pisciculture, it may be here remarked that all that it can do is to assist nature by the selection of the most favorable situations and conditions for the maturation of the ova, and the protection of them and of the fry from the attacks of the numerous enemies which threaten them. The attention of man may, therefore, be directed, with the greatest advantage, to such species as exercise no care for their eggs or young. Almost all the European species exhibit such neglect; but many of the fishes of this country guard, with jealous care, the eggs and young, and among them are some of the most esteemed species, the black bass being one of the number.

MODE OF OPERATION.

Illustrations of the processes necessary for artificial fecundation and propagation will explain better than words the mode of manipulating the pregnant fishes. It will be seen that the fish should be firmly seized by the hand, and that the other should be passed over the abdomen gently, but firmly, and the ova and milt, if mature, will readily pour out. Only those fishes which are mature should be treated thus. If the ova or milt comes out with difficulty, and only under hard pressure, it is a sufficient indication that they are not ripe, and it would not only injure the pregnant fish, but be useless as to results to anticipate the period of maturity. This uncertainty as to the period when the fish may be most advantageously manipulated, is one of the difficulties incidental to artificial fecundation. The fishes may be caught when they have apparently nearly reached their term, and be confined so as to be under the notice of the piscicul-

(Figure 1.)

MODE OF DISCHARGING OVA.



(Figure 2.)

IN-DOOR HATCHING-BOXES, etc.

1. Frame work of glass rods. 2. Tank with eggs resting on gravel. 3. Catcher. 4. Hand-net.

turist. When ripe they may be distinguished by their turgid sides, the pouting anus, and their uneasy movements.

APPARATUS FOR HATCHING.

Having secured the eggs of certain fishes and fecundated them, these may be transferred to receptacles for hatching them; various patterns have been recommended, but the principles followed are essentially the same in all. A fountain of clear running water—a spring is preferable—from which a small stream flows, or may be led, is selected; and if there is a gradual fall or descent, so much the better. A series of boxes, through which the water will flow, are placed in the position to be fed by the stream, and the floor of each box is covered with gravel or pebbles, which may furnish a bed for the deposit of the spawn. In the details of the form and construction of these boxes, and the manner of regulating the flow of the stream, the variations chiefly consist, and may be illustrated by reference to two methods.

One of these plans has been adopted by the "Thames Angling Preservation Society," and was elaborated and introduced by Mr. Francis Francis,* to whom we are indebted for the account, as well as the figure illustrative of it. The chief object in view was to increase the stock of trout, and to introduce the grayling in the river Thames. A spring, from which a rill flowed, was first obtained; to use Mr. Francis's own words, "there was a considerable fall in the run of the water, which was very advantageous; nevertheless, the plan here adopted can be applied more or less to any stream. We first bricked up the little rill so as to form a reservoir (1) and raise the water to a higher level; we covered the reservoir in with a large stone to keep out dirt and vermin, and placed at the lower end of it a zinc shoot, (2,) over which the stream flowed. Immediately under this we placed our first box, a fac-simile of which is given. It was made of elm, four feet long, and fifteen inches wide in the clear, and ten inches deep. At the upper end of the box a projecting zinc trough (3) was fixed to catch the water, this trough being about three-quarters of the width of the box itself. At each end of every box a piece was cut out six or seven inches in width, and through these the water flowed into each box.† The top cut, which *first* received the water, being secured from foes without by being covered with perforated zinc through which the water flowed, and the further end one having a zinc shoot to deliver the water; and also a perforated zinc face, not only to keep foes out, but the fish in. Fastened over the cut, in the lower end of the first box, was a short zinc shoot (5) to convey the water into the next box over the corresponding cut, so that no water should run to waste between the boxes. Thus, when No. 1 box was fairly placed on a brick foundation so as to receive the water in the zinc trough mentioned above, all that was required was to insert the shoot at the other end of the box into the corresponding cut of No. 2 box, and slide No. 2 safely and closely up into its place, and so on with Nos. 3, 4, and 5, &c. These boxes were then partially filled with coarse gravel, of the size of gooseberries, and some larger, even to the size of plums, for the more irregular their shape the better, as there will be the more interstices between them in which the ova can be hidden, and the little fish when hatched can creep for safety. The gravel was at a level of about an inch below the cut which admitted the water, an inch depth of water being quite sufficient to cover them. Each box was furnished with a lid, com-

* Fish Culture: a Practical Guide to the Modern System of Breeding and Rearing Fish, by Francis Francis, 12mo.; London, 1863.

† These openings were not carried all across the boxes, as the shoulders left made an eddy very favorable, as quiet resting places, to the young fry when first hatched. If the stream be at all strong, artificial eddies should be created by sticking small pieces of perforated zinc upright in the gravel at intervals along the sides and across the stream; behind these the helpless fry can be in safety.

prising a wooden frame-work, and a perforated zinc centre. This lid was made to fit closely by means of list being nailed on all round. It was padlocked down to keep out inquisitive eyes and fingers. Boxes in exposed places should always be covered in, if not with coarsely perforated zinc, yet with fine wire netting, or water mice will get in, and various birds, as moor-hens and dab-chicks will pick out the spawn, while a kingfisher, should he discover them, will carry off the fry by wholesale. The stream was then turned on, and flowed steadily from box to box throughont the boxes, and finally discharged itself by the end shoot into the bed of the rill. It need not be imagined that a full stream is necessary, for a small amount of water is sufficient. Indeed, a flow of water, say through a half inch pipe, would be enough, perhaps, though it is *advisable*, while the ova are unhatched, to have more, so that there shall be more stream and movement in the water, and consequently less time for deposit to settle; so that we had on, perhaps, as much as a stream of three-quarters or an inch in diameter. When the fish are hatched half that quantity would be preferable, as they are not well able to struggle against a stream, and would be carried down, perhaps, to the end box, and so against the perforated zinc face, where they would stop up the holes, and finally be smothered. The boxes were then properly steeped in water and seasoned, and being of elm the joints drew closely together after a while, and the boxes held the water without material leakage."

In each of the boxes thus constructed and arranged, about four or five thousand ova, or even more, are deposited; the gravelly bed in which they are spread is about one and a half or two inches below the "cuts" referred to in the preceding description. The ova are by means of a spoon regularly distributed, but from their numbers are quite close together; care is taken to have them among interstices of the gravel, such as are too prominent being carefully swept into some crevice by means of a fine brush. When thus cared for, a layer of gravel, composed of rather large flat stones an inch and a half or two inches square, is spread over the ova, heed being taken not to squeeze them. It may be remarked that the ova of the common yellow perch were hatched in these boxes.

Another apparatus for the same purpose has been decribed by Mr. Frank Buckland as being employed by the Messrs. Ashworth, the proprietors of the Galway salmon fisheries, and by means of which many thousands of salmon have been hatched. The boxes in this case are six feet long, one foot wide, and seven inches deep. They have board covers with perforated zinc fitting their tops and attached by hinges; each box overlaps above the succeeding, that all are fed by the same stream of water, which falls from the outflow of the one into the inflow of the next. "The inflow from the main stream must, of course, be regulated by a hatchway, (where the man is working with the fish kettle and net,*) and be guarded by perforated zinc, &c. It may be also, if naturally not very clear, filtered through gravel, charcoal, &c. It is not necessary that the boxes should be placed on the side of a hill, as represented in the drawing, but still they should be placed one above the other in such a manner that there should be a fall from one to the other. Nor is it absolutely necessary that the end of the upper box should rest on that immediately below it. The water may be conducted from one to the other by means of a trough or plate (with the margins turned up) of common zinc. The pond at the end of the boxes will receive the fish, but they should not be allowed to escape there till the umbilical bag is gone. The pond must not be above three or four feet deep, or if it be naturally deep, the margins must be made to slope, as the young fish like shallow water to bask, feed, and play upon. They must be fed for a time when in this pond."

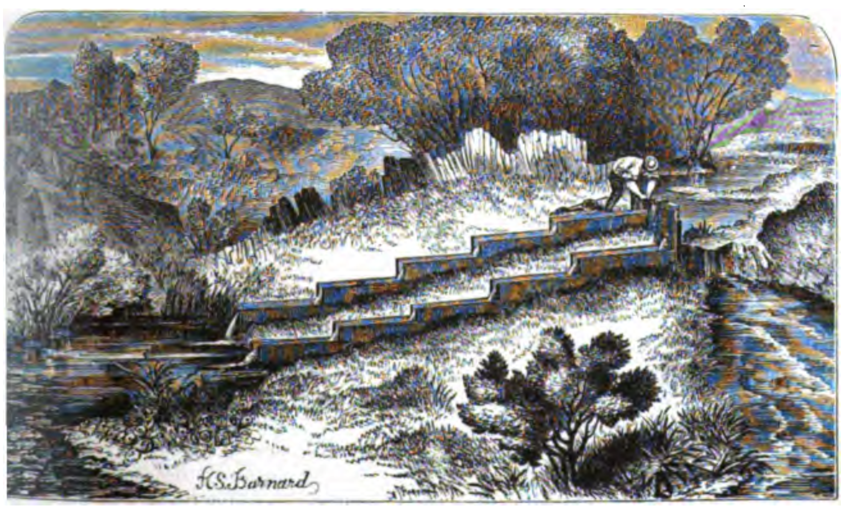
The in-door is considered far preferable to the out-door apparatus. The accompanying drawing shows the troughs best suited for the purpose, each being fitted with a top, which conducts the water from one to the other. The troughs

* See figure copied by Mr. Buckland's "Fish Hatching," 12mo: London, 1863.

HATCHING-BOXES.

(Figure 3.)

1. Reservoir. 2. Shoot through which water is discharged. 3. Trough to catch the ater before it passes into the box. 4. Perforated zinc. 5. Shoot to discharge water.



(Figure 4.)

HATCHING-BOXES.

(Figure 5.)

ARTIFICIAL SPAWNING BED.

can be multiplied, one above the other, *ad infinitum*. Figure 1 indicates the hands of the operator placing in the frame-work of glass rods, upon which the eggs are left to hatch. The lower tank (Figure 2) represents the fresh eggs resting upon the gravel. The water from the top above must be flowing incessantly, but gently. Boards should be fitted on the tops of the troughs while the eggs are being developed. The tanks can be made of zinc, two feet long, five inches wide, four inches deep, with one side of glass. Figure 3 represents the catcher, a useful instrument for moving the eggs without touching them. Place the finger on the end of the straight part of the tube, immerse it in the water, and bring the lower end opposite the egg or impurity you wish to remove. When the finger is withdrawn the water rushes into the tube, and with it the object you wish to withdraw. Figure 4 represents a net of common wire, for catching the young fish. This in-door apparatus can be fixed up almost anywhere under cover, except in a *hot* greenhouse.

These examples of hatching-boxes will suffice, and the accounts, given in the words of their describers and illustrated, will convey a clear idea of the objects to be kept in view in the construction of such apparatus. It will be understood that the details in their arrangement are susceptible of considerable modifications, and many patterns have been described, but they offer no material difference. The requisites are an appropriate bed for the deposit of the spawn, a running stream of clear water, so as not to allow sediment to settle or a confervous vegetation to exist, as that would kill the ova; and protection from enemies must finally be provided for.

ARTIFICIAL SPAWNING BEDS.

While artificial fecundation apparently fulfils the chief requisites for the propagation of some fishes, such as the salmonids, there are others for which it cannot be employed with equal advantage. Nature has, in such cases, been assisted by the preparation of places suitable for the deposit of the ova and milt of the fishes which it is desired to propagate, and by the preparation for such of beds which will be instinctively resorted to by them. This practice has been especially employed in France, and has been very recently advocated by the celebrated academician, M. E. Blanchard, professor at the museum of natural history, &c., in an excellent work on the fresh-water fishes of France. The obvious advantages resulting from the exposition of an author's own words, induce the writer to submit a translation from M. Blanchard's work, as well as a copy of the figure illustrating his description.

"In view of the present condition of the rivers and canals of France, the idea of artificial spawning beds would appear to be a most happy one. M. Millet, before the Society of Acclimatization, has insisted, with great earnestness, on the preference to be given, in many cases, to artificial spawning beds over artificial fecundation. M. Coste has justly remarked that artificial fecundation is not all-sufficient, and yet a contrary opinion is generally prevalent. No one has forgotten the marvellous results which we were to obtain by means of artificial fecundation; fishes, left to themselves, could not thrive and have a numerous progeny. Their duties should be assumed by us, and the advantages would be incalculable. More than fifteen years have elapsed since these seductive announcements were made, without having yet furnished brilliant results.

"Among fishes, some, as the salmon, deposit their ova in slight excavations, in gravel, or in the interstices between stones; others, as the perches and cyprinids, (carp, bream, roach, &c.,) attach their ova, agglutinated together by means of a viscid matter, to aquatic plants, stones, or any bodies to which their eggs can be fixed. It is especially for the last that artificial spawning beds might sometimes be advantageously prepared.

"The construction of an artificial spawning bed is a very simple matter. A framework of sticks or laths should be made, and to such framework, boughs,

furze, and aquatic plants should be fastened by cords, in such a way as to form irregular structures. It is also easy to give to structures of this kind a circular form, by taking hoops for frameworks. The form, and especially the size to be given to these spawning beds, would necessarily vary, according to the character or the size of the body of water in which they are to be immersed. They should be held to the bottom of the water by stones, and fastened to a stake or post on the bank. When kept in place in this way they can be easily drawn out of the water, if it becomes necessary to do so.

"It will be readily understood that these artificial spawning beds will be especially serviceable in those streams and canals which are so clear as to be devoid of any natural spawning beds.

"For the salmonids, which spawn on a gravelly bottom, and whose ova remain free, artificial spawning places are very simple and readily prepared. It is only requisite to cover in certain places the beds of rather shallow and rapid streams, near the bank or the bottom of rivulets, with a thick layer of gravel or pebbles, and to prepare slight excavations or furrows, like those made by the salmon or trout, to deposit their eggs in. M. Millet also recommends that small heaps of pebbles should be raised at the edges of these furrows. By means of these contrivances, trout especially would often be attracted, and be content to stop and spawn in places which they would not otherwise frequent, and where it would be convenient to keep them."

PISCICULTURE MOSTLY APPLIED TO FRESH-WATER FISHES.

While pisciculture may be applied to most of the desirable salt-water as well as fresh-water species, the fecundation and propagation of fresh-water fishes has received much more attention than the salt-water species, especially in this country, and the reason for this is apparent on slight reflection. The salt-water species have the ocean open before them, and the whole extent of coast to range along, and the utmost efforts that man will be tempted to exert, with the present population of the country, to supply himself, will not effect a very sensible diminution of their numbers, and will apparently do little more than give an opportunity for others to take their place and sustain themselves in the struggle for life. Such at least is the case with regard to the inhabitants of the deep seas or the banks, as the mackerel, codfish, and herring; nor has even the numbers of the shad and its congeners, or of the capolin, whose enormous masses advance upon the coasts of Newfoundland and the northern coast, yet been very seriously diminished, notwithstanding the wicked and scandalous waste practiced, especially in case of the last. The number of savory species also is so great, that there must be few persons so fastidious as not to be satisfied with some one or more of those species; and as all can be obtained in quantities that may at least meet any present demand, incentives to introduce new forms are wanting, and the necessity of propagating indigenous ones by artificial means does not yet exist. While this may now be the case, however, let us not flatter ourselves with the pleasing reflection that we can with impunity kill young and old, and that they will be replaced by others, who, in their turn, will share a similar fate. Nature is, indeed, prolific enough to satisfy all reasonable demands; but if she is drawn upon too heavily and no efforts are made to assist her, she will most assuredly protest, and finally refuse to yield sufficient to supply our wants. Let the diminished supplies of fish supplied by the British seas, and which have already attracted the attention of the statesmen and thinkers of that land, serve to us as a timely warning not to push nature too far.

RECKLESS PURSUIT OF FRESH-WATER FISH.

While the inhabitants of the seas, from their less dangerous proximity to man, have sustained comparatively few losses, it is far different with regard to

some of the anadromous and fresh-water species. That fish which has been styled the king of its class—the salmon—has been either entirely driven from his old haunts, or is in danger of speedy extermination by that wanton waste and disregard of all sound sportmanship or prevision for the future which is so unhappy a characteristic of too many of our countrymen. The salmon was formerly abundant in the Hudson and Connecticut rivers, as well as in the smaller rivers near them, but has long since been driven from those waters, and, indeed, from all those of the eastern slope of our possessions, except the northern regions of Maine. It is not probable that this has been the necessary result of a refined civilization, for the same species still abounds, although in much diminished numbers, in the rivers of Britain, despite a far more crowded population and a greater number of at least true sportsmen, and for this we may thank the judicious laws that have been passed, and which—still more to the purpose—have been enforced by the legal authorities, as well as by the approbation of a large proportion of the intelligent population. The waste and unsportsmanlike pursuit of our game animals have been commented upon in terms of just severity and indignation by several of our best sportsmen, and it is to be hoped that the public voice, in deprecation of the wasteful and pernicious persecution of our animals, may be felt in time to prevent the extermination of many whose numbers are fast diminishing, and whose speedy extermination is certain, unless timely interposition is made.

RESTOCKING WATER WITH NEW OR LOCALLY EXTERMINATED SPECIES.

When the ill-advised pursuit of any game animal has culminated in its extirpation in any district, it is, fortunately, in some instances, feasible to reintroduce the species; and the study of the habits of fishes has placed in our power the means of restocking our streams with the salmon, whose extermination therefrom we deplore, and by the same means we may be enabled to introduce new species. The salmon or trout will not live in every stream, but there are many species which, though inferior to those royal fishes, are nevertheless very savory and estimable as food, which could with advantage be propagated in many ponds or streams now producing nothing of value, and even regarded as a nuisance, entailing the loss of so much arable land. In Europe, and especially in Germany and France, submerged land is almost or quite as valuable as that which is tillable; and in some situations, alternate crops of corn or vegetables and fish are cultivated. The land, after several years' cultivation, showing signs of exhaustion, is flooded by water and converted into ponds in which fishes or their fertilized spawn are distributed, yielding in due time a fruitful progeny. In a few years, the water is drained off and the fish sold, frequently affording more profit than the land when cultivated. In England, likewise, a body of water is almost, if not quite, as profitable as an equal extent of dry land; and, it may be added, the same is the case with regard to China. The time cannot be far distant when our waters, too, will be utilized like those of Europe and China; and in view of this contingency, it will be well for us to study our native fishes, as well as to inquire what, among foreign species, may be rendered most subservient to our needs, and be propagated with the most advantage, or be the most useful and savory for the table, and, at the same time, involve the least expense in cultivation.

SUB-CLASSES OF FISHES.

The great class of fishes is divisible, at least as far as the economical species are concerned, into four primary groups or sub-classes, of which the perch and trout, the sturgeon and bony gar-pike, the shark and ray, and the lamprey, are examples. All these groups furnish to man more or less wholesome and savory food, but which is variously appreciated in different countries.

Teleosts.—The first group is known by the name of Teleosts, and is so called because the skeleton is always ossified, although in a few rather imperfectly; the name is derived from the Greek τελεος, *(teleos,)* complete, and οστεον, *(osteon,)* bone; in this group are comprised the great majority of fishes, and especially those which are held in the highest esteem for the table, such as the cod, herring, mackerel, flat fishes, cyprinids or carps, suckers, &c., besides the salmonids and percids before mentioned.

Ganoids.—The second group, or that of the Ganoids, is at present represented by few species, but it is celebrated on account of the important part which its members played in the ancient history of our globe. When the teleosts, or typical fishes, had not yet been called into being, the ganoids were numerous in species and individuals, and of strange and various forms, and some of them disputed for the mastery of the waters with the sharks, which were then, as now, represented in all seas. At present, however, the ganoids are few in numbers, and, with one exception, very restricted in geographical distribution, two of the five known forms being represented in North America only.* The most widely distributed type is that of the sturgeons, species of which occur in the seas and larger rivers and lakes of the entire northern hemisphere, at least in the temperate regions. Most nearly related to the typical sturgeons, and, like them, living in the Old as well as New World, are the shovel-nosed or spoon-bill sturgeons; one species of the family is found in the hydrographic basin of the Mississippi, and representatives have been lately discovered in China. Of the other three families, two are confined to America, and one to Africa. One of the American types is well known and celebrated for its dense armor and fierceness, in allusion to which defensive armor, consisting of bony scales, it has been named Lepidosteidæ. Of this form there are many species. The other characteristic North American type is the family of Amiids: the species of this group are few in number, and are called generally bow-fins or mud-fishes. The only other type (if the Lepidosirenids are excluded) is the family of the Polypterids, of which two genera are represented in African rivers; both are armed with rhomboid bony scales, like those of the Lepidosteids. The only one of these families which embraces fishes that are in ordinary use as food is that of the sturgeons.

Elasmobranchiates or Selachians.—In the third group, called Elasmobranchii, on account of the structure of the gills, the sharks and rays are included; the latter alone, in this country, are used to any extent as food, but the sharks are much sought for by the Chinese, on account of the fins especially, and the countrymen of those people living on the Pacific coast of the United States have brought with them the tastes of their kindred.

Dermopters.—The fourth and last of the groups, that of the Dermopters or lampreys, is represented in most countries, and by some people are held in high esteem for the table as an article of diet; while brought to the markets of our large northern cities in season they are not in very general use, in the country at least.

With this introduction, it will be advisable to inquire which among our own fishes are most worthy of propagation.

CHARACTERISTIC FORMS OF TELEOSTS OF FRESH WATER.

For this purpose, perhaps, the proper plan will be to enter into a brief examination of the best known species dwelling in our streams and lakes, and to compare them with those which inhabit other portions of the world, and especially Europe. We need not shrink from this task on account of any poverty of our waters, either with respect to individuals or species. Although it might interest

* Two species of Lepidosteids are inhabitants of the rivers of tropical America, one living in Cuban streams and another in those of the Isthmus of Darien.

the naturalist, it would be out of place here to enter into the detailed statistics of our fresh-water fish fauna, and we must necessarily confine ourselves within narrow limits. This much, however, we can state: no country in the world produces so many fresh-water types as does the United States, and eight families—a large proportionate number—are either peculiar to this country, or extend not very far beyond its borders. These are, the Etheostomids or stone-toters; the Centrarchids or sun-fishes, and kindred forms; the Hyodontids or gizzard-shads; the Percopsids; the Aphredoderids; the Amblyopsids, (blind and cave fishes;) the Amiids or bow-fins, and the Lepidosteids, or alligator gars. In addition to these, two other characteristic forms—the Catastomids or suckers, and the Polyodontids or shovel-noses—are elsewhere represented only in northern Asia or China, countries whose fauna and flora often recall to the American features of his own country. Finally, types which are elsewhere represented very sparingly, are in the United States comparatively richly endowed; such are the Esocids or pikes, and the Umbrids or mud-fishes. The economical value of these and the other forms represented in America we may now discuss, and at the same time, more precise information as to their distribution will be given.

ECONOMICAL AMERICAN FRESH-WATER FISHES.

Percids or Perches.—The Percids are a family very numerous in genera and species, and distributed in the seas at least of all temperate and tropical countries—the groupers or snappers, so esteemed as food, being members thereof. The fresh-water forms are most numerous in the United States and Europe, and representatives of three distinct groups, at least, inhabit the lakes or streams of the former country—some of our best fishes belonging to them.

True Perches or Percines.—The Percines, or typical perches, are recognizable by the elongated form of the body, and the numerous spines of the first or spinous dorsal fin, the number of which ranges from twelve to fifteen. The common yellow perch—*the perch, par excellence*, of England—and the pike-perch, both belong here. The common yellow perch (*Perca americana, Schrank**) is very generally distributed in our fresh waters, and affords to juvenile anglers much sport; but it by no means has the high repute in this country that its congener has in Europe, either as a game-fish or a table-fish, and it is rarely found of so large a size as has been attained by the European. It is gregarious in its habits, carnivorous and voracious, biting readily at the baited hook; it is a hardy fish, and can be readily domiciliated in any pond or stream. Dr. Samuel L. Mitchell, a well-known physician of New York, who flourished in the first quarter of this century, and enjoyed at that time a high reputation for learning, as early as 1790 introduced it into Success Pond, a small body of water in Queen's county, Long island; with the assistance of a relative, he obtained about three dozen fishes in "Rockankama Pond," a lakelet in Suffolk county about forty miles distant from Success Pond, and filling a large churn with water, placed therein the fishes caught, and transported the whole, without accident, in an ordinary wagon; the fishes were turned into the latter pond, and soon propagated and multiplied. This was perhaps the first attempt in this country to transport an indigenous species to any distance and introduce it into a new body of water. Since that time, its introduction into other waters has been effected. In view of the hardiness of this species, and the ease with which it can be propagated, it may be introduced into waters where more choice fishes would not flourish; but when so many others, more estimable, may be had, it would scarcely be advisable to stock with this fish waters fitted for its betters.

Much superior to the yellow perch are the pike-perch, (*Stizostedion amer-*

* This species is called Perca flavescens in the works on game-fish and fishing published in this country.

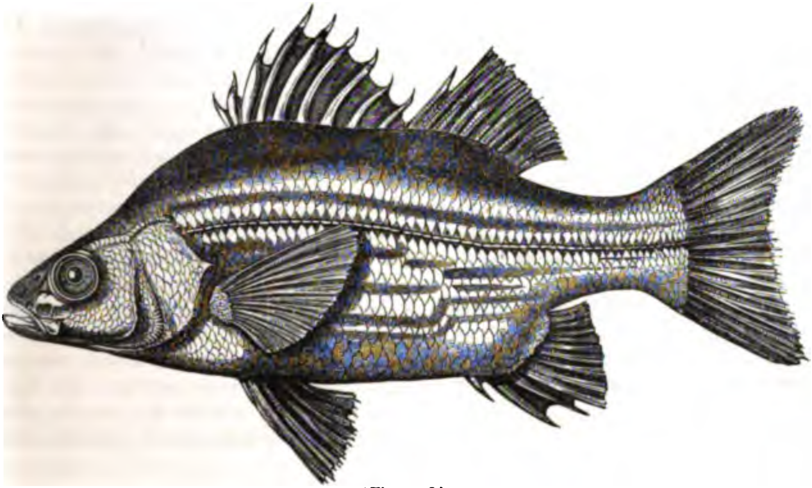
icanus, &c.,*) which are also known in different sections of the country as the "glass-eye," "pike," and even "salmon." As so much confusion and misconception prevails respecting the species among anglers and others, an exposition of their true relations will not be superfluous. The species are most closely related to the common yellow perch, differing chiefly in a more slender and rounded or sub-cylindrical form and a smoother and more pointed head, with a larger mouth and much sharper and stronger teeth. They have no affinity or likeness whatever to either the true pike (*Esocids*) or salmon, and both those names are equally inappropriate.† As remarked in my "synopsis of the sub-family Percinæ," the genus is "peculiar to the fresh-water streams, rivers, and lakes of North America *and Europe*."‡ The representatives of this genus are savory and excellent fishes, and would, in a gastronomic point of view, be worthy of introduction into natural or artificial waters; but they are very voracious, and would make havoc among weaker species, and these habits should be taken into consideration before attempts are made to domiciliate them in fish preserves. In large bodies of water, however, their introduction might be advisable. In the most northern States they spawn in April or May. The species attain a goodly size, often exceeding two feet in length.

Basses or Labracins.—The Labracins, or true bass, form a second tribe in this family, and all the species are esteemed for food. To it belong the striped bass and the white perch and their allies. It is a singular fact that the several members differ from their nearest relations in habits, inhabiting, in one case, by preference, the fresh waters, or even entirely confined to them, and in the other affecting most the salt waters and found only exceptionally in the fresh. Thus the tribe in America embraces two very distinct genera—*Roccus* and *Morone*. *Roccus* includes the rock-fish, or striped bass, whose praises have been so widely sung, and which is, as every one knows, a salt-water fish, ascending the rivers only to spawn, and a nearly related species, bearing the same name and also known as the white bass, which was originally confined to the great lake and Mississippi systems of waters, and which never descends to the salt waters. The two are so much alike, however, as to have been confounded, and to have afforded theorists an argument in favor of the transportation of the eggs of fishes by birds! They differ, however, very much in form, the white bass being far higher and more compressed than the rock-fish, and also distinguished by peculiarities of dentition. The white bass never attains the size of the rock, rarely exceeding two pounds in weight. We may pass by the rock-fish (*Roccus lineatus*) with the simple remark that Mr. Pell, a gentleman as well known for practical skill in pisciculture as in agricultural pursuits, has succeded in acclimatizing the species in fresh water ponds. The white bass (*Roccus chrysops*) is almost equal to its larger relative for the table, and is one of the most abundant species in the great lakes and Mississippi tributaries, and the circumstances under which it is found indicate that it would not be very difficult to naturalize it in ponds. It is carnivorous in its habits, and rather greedy. In the northern waters it spawns in May, selecting a gravelly bottom for the deposit of its eggs. The colors are somewhat striking, the ground being silvery white, covered on the back and head by an olive brownish, and with a number of blackish lines, more

* The common pike-perch appears, in the American works on angling, under the name *Lucioperca americana.*

† In Mr. Herbert's (Frank Forrester's) Fish and Fishing, a singular caricature is published as a figure of the pike-perch, representing the ventral fins situated at the middle of the abdomen, and in many other respects erroneous. In a subsequent appendix he states that "he borrowed both the description and cut from Dr. Dekay's Fauna of New York," and regrets the incorrectness. Had Mr. Herbert compared the two figures he would have seen that no likeness existed between them, and that Dr. Dekay's figure was a correct representation of the species.

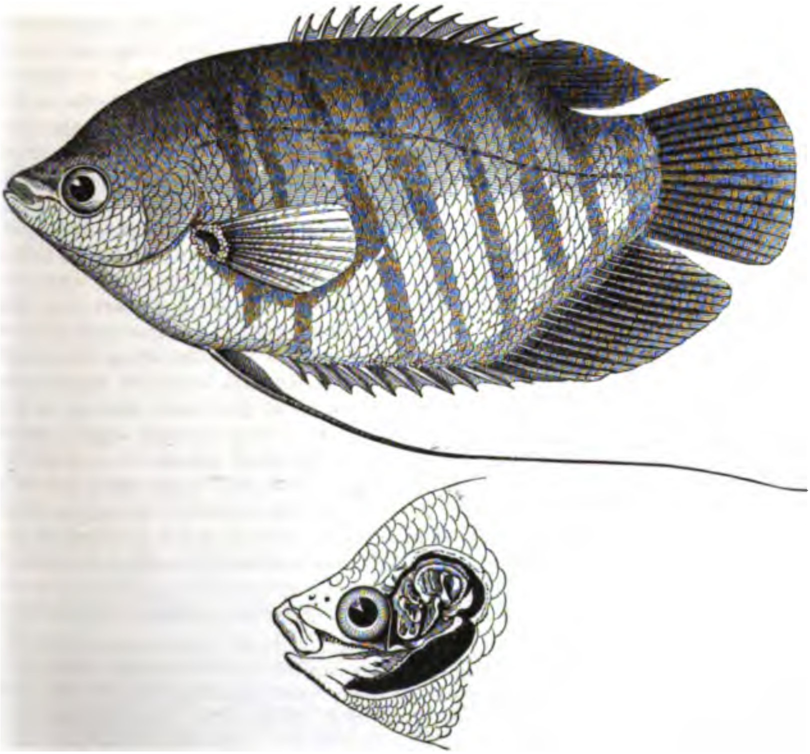
‡ Europe, in this connection, is used in the zoological sense of European province, as a species of the genus occurs in Russian Asia.



(Figure 6.)

MORONE INTERRUPTA. (*Gill.*)

"SHORT STRIPED" OR "BRASSY BASS."



(Figure 7.)

OSPHROMENUS GOURAMI. (*Com.*) "GOURAMI."

or less interrupted, running along the sides, thus resembling, in the pattern of coloration, the rock-fish, but differing in the much finer lines.

Next we have the genus *Morone*. This includes the ordinary white perch, (*Morone americana*,) and a handsome species inhabiting the Mississippi river (*Morone interrupta*,) which scarcely differs from its relative in form, but is strikingly distinguished by color.

The white perch prefers at least brackish waters and the neighborhood of the sea, but, like the rock-fish, it ascends rivers to breed, and can and does live in fresh-water streams and ponds entirely isolated from the ocean. Some of those found in ponds so isolated have a somewhat peculiar physiognomy and a dark hue, which have procured for them specific separation from the ordinary form under the name of small black bass *(Labrax nigricans)*; there is, however, no structural difference between it and the type, and the name given to it has been the means of leading several writers into the very grave error of confounding it with the lake or true black bass, an entirely different fish. The white perch of the more northern and southern coasts have likewise been specifically distinguished by some anglers under the name of ruddy bass for the northern, and white perch for the southern forms; but I must believe, notwithstanding the strong expressions of opinion to the contrary, that there are no valid distinctions between them; and in similar "stations" the forms so distinguished may be found either in the northern or southern waters. Although never attaining a very large size, it is held in high esteem for its flesh, and is especially valued as a "pan fish," and is a favorite object of sport to juvenile anglers as well as those of larger growth. It is omnivorous as to food, and bites at the baited hook with great eagerness. In the month of May it deposits its spawn. It could be readily introduced into ponds, and might be an acceptable addition to many.

The species already referred to as found in the Mississippi appears to be common between St. Louis, Missouri, and New Orleans; its further range is unknown, and we are but imperfectly acquainted with its habits, but they are doubtless analogous to those of the white perch, with the exception of a greater preference for fresh water. It has, indeed, been made known to the scientific world within the last few years, and the only work on game fishes or angling in which it has been mentioned is that of Mr. Norris, (American Angler's Book,) in which the name of "short striped bass" is given, together with a brief description of its peculiarities and habits. Mr. Norris, although unacquainted with the scientific name and publications concerning this fish, was happy in his appreciation of its affinities, aptly remarking that "if the reader will imagine our white perch with stripes on its sides—resembling those of the rock-fish, though not so numerous—he will have this bass in his mind's eye." If, to this statement, we add that the general color is bright brassy, shaded by olivaceous on the back, and that the bands are well defined, rather broad, and of a blackish color, and that those below the lateral line are interrupted, so that the hinder portions are on a lower level than the anterior and alternate with them, a good conception may be formed of their characteristics. It is, indeed, a handsome species; and as no figure has been published in a popular work—a want which Mr. Norris deplored—one is here supplied, being a copy of one drawn under Dr. Steindachner's supervision, and for the correctness of which I can vouch. Mr. Norris states that it is "not inferior to the white perch," and that it resembles that species in flavor and the firmness of its flesh. The beauty of coloration, as well as its excellence as a pan fish, recommend it to the attention of the pisciculturist, and it would doubtless well repay the trouble and expense attending its introduction. In beauty of colors it far surpasses the gold fish.

Black Basses or Micropterins.—The third and last tribe of Percids represented in the American fresh waters is that of the Micropterins, distinguished by a robust

form and the small size of spinous portion of the dorsal fin. It embraces the celebrated black bass (*Micropterus achigan*) and related species, and its representatives are in high repute for excellence as food as well as for the vigor of the "play" and the sport which they afford to the angler. To this genus belong the fresh-water "trout"* of Florida, the "salmon" of South Carolina, the "welshman" of certain districts of North Carolina, and the "chub" or "Roanoke chub" of upper North Carolina and the southern counties of Virginia. The best known species are the small-mouthed black bass (*Micropterus achigan*†) and the large-mouthed black bass (*Micropterus nigricans*.) Both are voracious in their appetites, bold biters, and take with savage earnestness live bait as well as the spoon, and are generally similar in their habits. The small-mouthed species is, however, more esteemed than its congener, and would be, therefore, most worthy of the pisciculturist's attention; it is also said to be superior to the large-mouthed species as a game fish.

In the northern States, the black bass spawn in the month of May, the males and females pairing, and, separating themselves from their companions, select some place where the water is shallow, but not far from that of greater depth, to which they may retreat when in danger. From the spot chosen they clear a circular area, of about a foot in diameter, (varying somewhat with the size of the fish,) of weeds, large stones, and other inconvenient matter, and the female therein deposits her eggs, in rows, glued to the bottom or to the small stones left in the nest. The fruitful nest is guarded by at least one of the parents—the mother—who assiduously protects her precious deposit from all intruders, sallying forth and assailing any fish, not too large to manage, which may approach its vicinity. The eggs are said, by Mr. Eoff, to be hatched in eight or ten days, and by Dr. Garlick in *two* or *three* weeks. The liberated young remain for several days over the nest, and at last disperse and shift for themselves.

The introduction of the black bass into other waters has been advocated, and the Acclimatization Society of Melbourne, Australia, proposes to attempt its naturalization into the waters of that country. The common small-mouthed species (*Micropterus achigan*) is, in truth, well entitled to command the efforts of the pisciculturist, and could be introduced most advantageously into many sheets of water at present affording fishes of inferior quality. Much has already been unwittingly effected in the extension of its area by the opening of canals, and it is now domiciliated in the Hudson river and some of its tributaries, as well as in other regions. In introducing the species in new waters, young fishes would, perhaps, be as useful as the ova. The fry, when brooding over the nest, after emerging from the egg, could be obtained with great ease, and would doubtless bear transportation without much loss. The rapidity with which the eggs reach maturity, as well as their viscid character, render artificial spawning far more difficult than in the case of the Salmonids. Dr. Garlick, however, in his "Treatise on Artificial Propagation," uses language which would appear to warrant the inference that he has succeeded in raising them, without noticeable difficulty, by artificial spawning. It would not be advisable to stock small ponds with the species; and to insure a sufficient supply of food for it, some prolific fish should be cultivated with it—herbivorous species, such as the chub-suckers (*Moxostoma oblongum*, &c.,) recommended by Dr. Garlick, or other Cyprinoids, would be best.

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* The salt-water "trout" of the southern States is closely related to the northern "weak fish," and its correct scientific name is *Cynoscion carolinensis*, (*Otolithus carolinensis* of the works on angling.)

† The Micropteri, in works on angling, are called or included under the name of *Grystes salmoides*, *Grystes nigricans*, and *Grystes megastoma*, and have been confounded with the *Labrax nigricans* on account of the similarity of the popular names.

CENTRARCHIDS OR SUN-FISHES.

Few or no fishes are so familiar to all, and so generally distributed throughout the temperate regions of North America, as are the species which are most commonly known under the various names of sun-fishes, rock-bass, grass-bass, goggle-eye, &c., and which belong to the family of *Centrarchidæ*. All the fishes of this kind are peculiar to America, none being found in the Old World, and it is probable that they are even confined to North America, and extend southward little beyond the United States. Fish have, indeed, been described as allied to them from South America and Cuba, but evidently through error. In the tropical regions of continental America, as well as in Cuba and Trinidad, the species of the family are replaced by those of a somewhat kindred one, (*Cichlidæ*,) resembling them in habits, as well as in general form and colors. The habits are not the least interesting feature of their history, for they form one of the numerous arguments against the callous nature attributed to fishes, in regard to their eggs and young. In the spring or summer, pairs of sun-fishes may be found at short distances from each other, in ponds or sluggish streams, near the banks, and generally in places where weeds and grasses flourish. In such places, each pair occupy a more or less circular area, which is in the midst of vegetation, but is itself bare, and here they spend the greater part of their time. One is a male, the other a female. By their labor, the spot has been cleared of the vegetable growth, and a nest formed of gravel and stones, after which the eggs are laid and fecundated, covered with the earth, and the parents remain to guard the precious deposit from all enemies. Their courage is frequently put to the test. Often some venturous fish, or perhaps some finny traveller, intent on other things, approaches the sacred spot, and one of the pair immediately sallies forth and drives away the intruder, frequently much larger than itself, and continues the chase till it has placed a sufficient distance between the stranger and its nest.

Numerous individuals, symmetrical in form, often decorated with striking colors, and of considerable size, the *Centrarchids* are everywhere well known, and furnish favorite subjects of sport to the juvenile angler, as well as to those of riper years. They are all bold biters, but vary in their habits, their voracity, and their adaptability and excellence as food. The common sun-fish is provided with a small mouth, and is generally content with worms and inferior animals; but the rock-bass and its kindred are better armed, more voracious and more unsparing in their food, many smaller fishes falling a prey to their pursuit. It is also among the last that we find the species most savory for the table, as well as those most esteemed as game by the angler.

All the species of the family have a very regular, oval, or elliptical and equally balanced body, the region above and below a line drawn through the middle of the body nearly corresponding to each other. A single fin runs along the back, of which the anterior portion is supported by strong spines, and the posterior by branched rays. Most species have in the front portion ten spines, rarely nine or eleven, and, in the soft portion, from ten to thirteen rays; exactly opposed to the soft portion, and ending at a line with the same, is the anal fin. That species belong to the sub-family *Lepominæ*. In other species, the anal is nearly as large as the dorsal, and obliquely opposed to it; such form the group called *Centrarchinæ*.

Lepomines.—It is to the group of *Lepomines* that belongs the well-known fish more generally known, especially in the middle and southern States, as sun-fish, but which also rejoices in the names "pumpkin seed," "kiver," "tobacco-box," and "pond perch." The naturalist's title is *Pomotis aureus*, or *vulgaris*, the generic designation alluding to the ear-like prolongation of the operculum or gill-cover, which is quite characteristic in color, the large, deep black area being bordered

behind and below by a vivid red, and above by yellow. This fish is very widely spread throughout the Atlantic and Gulf States, and the Mississippi basin, as well as the northern British provinces. Its neat and symmetrical form and handsome colors have led to its introduction into artificial ponds and aquariums, and it is readily raised. Worms are the favorite food. Less widely diffused, but often occurring in the same waters with the common sun-fish, are the large black-eared sun-fish, or *Lepomis appendix*, and the long-eared or red-bellied sun-fish, (*L. auritus*.) The former does not range so far eastwards as the common sun-fish, and the latter is mostly confined to the Atlantic and Gulf States; and, even within their respective areas, they are, in some regions at least, less universally diffused than the common species. In habits, they agree, in most respects, with that species. The red-bellied, however, prefers deeper water, and is a superior fish.

Passing over numerous small species, which, nevertheless, are of much interest on account of peculiar modifications of structure or beauty of coloration, several large-mouthed representatives of the tribe may be mentioned, which prefer small fish or crustaceans (craw-fish) to worms as food. Chief of these is the "rock bass" or "goggle-eye," of the western States, (*Ambloplites rupestris* or *æneus*.) one of the most esteemed of fresh-water fishes, and characteristic of the great lake region and the Mississippi basin. It is a fish of symmetrical form, plump and firm, of sombre colors, and is recognizable by its eleven dorsal and six anal spines.* It has spread from its native waters into the Hudson river and other streams, having wandered into them by way of the connecting canals, and is now quite domesticated and abundant in its new home. It is readily reared, spawns about the middle or in the latter half of May, by preference on a gravelly bottom, and attains a weight of about a pound in two years; the growth thereafter is arrested or comparatively slow. The superior quality of this fish as an article of food and its capability of being easily raised, render it worthy the attention of pisciculturists in an especial degree. A nearly related type (*Archoplites interruptus*) is an inhabitant of the Californian waters, where it is the sole representative of the family and, indeed, of the sub-order of Acanthopterygians, so far as the forms of economical value are concerned. And it may be here remarked, *en passant*, that the paucity or little variety of fishes in the streams and lakes of the Pacific States would seem to invite attention to pisciculture and to the introduction of desirable species from regions more favored in that respect. A third form of the large-mouthed Lepomines with numerous anal spines is found in the streams emptying into the Atlantic, from Rockland county southwards, and is known as the *Acantharchus pomotis*. Its size is small, and its economical value insignificant.

In addition to these large-mouthed species with many anal spines, several species with almost equally large mouth, but with only three anal spines, as in the sunfish, are found in the Mississippi basin and westward, and belong to the genus called *Chænobryttus*. Their habits being scarcely known, however, this allusion to them must suffice.

Centrarchines.—In the group of Centrarchines, several interesting or useful species are embraced. The species which serves as the type of the group (*Centrarchus irideus*) is indeed of little or no value as food—rarely exceeding six inches in length—but it is remarkable by the great number of spines with which the anal fin is armed, there being eight or nine, or more by two at least, than in any other fish found east of the Rocky mountains. The generic name has been given in allusion to this great number of spines, and is composed of

* As Mr. Herbert's (Frank Forrester's) Fish and Fishing is truly a guide to most anglers, it may not be superfluous to remark that his figure of the rock bass (p. 198) is a very poor illustration of an entirely different fish, (*Hyperistius hexacanthus*.) The description is, however, compiled from Dekay's account of that fish.

two Greek words signifying spiny anus, (κεντρον—spine; αρχος—anus.) As the anal fin is proportionately lengthened, the anus or vent is far forward or at the breast. This species is an inhabitant of the waters of South Carolina, Georgia, and Florida.

Far superior in size and esteemed as food are the species most closely related to the *Centrarchi*, and which are popularly known under the names of "goggle-eye," (South Carolina,*) "sac-à-lai" or "chinkapin perch," (Louisiana,) "crappie," (St. Louis, Missouri,) and more generally in the west as "grass bass;" all these different names being applicable to the same species. Several species very closely resembling each are, however, confounded popularly. That most common and widely diffused is the *Pomoxys* or *Hyperistius hexacanthus*, originally described from South Carolina. It often exceeds a foot in length, and has a much compressed body of an oval form, the mouth large, the snout pointed, but somewhat retuse and with the lower jaw projecting; the dorsal and anal fins, as already mentioned, nearly equal in size, obliquely opposed, the former having seven or eight, and the latter six, spines, and the spinous portions comparatively very small. The color is bronzed or dusky green, spotted with brownish above and on the sides; below, whitish. It is very highly esteemed by many for the excellence of its flesh; is hardy and readily raised, and spawns in May (Garlick.) It appears to prefer ponds and lakes, but is found in all bodies of fresh water. It is not a native of the seaboard of the middle or eastern States, and might be introduced with advantage from Lake Champlain or the lakes of northern or western New York. It affords considerable sport to the angler, and may be taken by a minnow bait.

Species of less robust habit and with a smaller number of dorsal spines (six) are found in the Mississippi basin, and are similar in habits and other respects to those of the section *Hyperistius*. They scarcely attain so large a size, however. The generic name *Pomoxys* is employed for them.

Esocids or Pike.—North America is, *par excellence*, the home of the Esocids or pike and pickerel. One species alone is found beyond its borders—the *Esox lucius*, or common pike of Europe. Even that species, or at least one scarcely distinguishable from it, is found in this country, and many other species occur throughout the same region. None, however, are found in the far west or on the Pacific slope of the continent. All the representatives of the family have the same general physiognomy—an elongated body, with the back and abdomen nearly parallel, the dorsal and anal fins opposite and far behind, the head flattened above, the mouth large, and with long, acute teeth, but of unequal size, on the lower jaw, in addition to which are broad bands on the palatine and vomerine bones. Much confusion concerning the most common species exists in the works on the game fishes, and an attempted rectification may be useful.

There are two groups of species represented in America: one composed of large species whose suboperculum, as well as the lower half of the operculum, are scaleless, and which are generally known in this country under the name of "muskellunges," although the common pike of Europe is the typical member of the group. Two well-defined species are found in the United States.

The second group comprises more numerous species, of smaller size, and with the cheeks and opercula completely covered by scales. The species are confounded by anglers under the name of pike, or, more generally, pickerel.

The form identical with, or, at any rate, almost undistinguishable from, the

* It must be borne in mind that the "goggle-eye" of the southeast is very different from the fish called by the same name in the west—the *Ambloplites rupestris*. It is in this, as in many other cases, essential that the scientific name should be added, or that the country of the speaker or writer should be known before certainty as to his meaning can be insured.

European pike, *(Esox lucius,)* may be first mentioned. It is this species that was originally described under the name of *Esox estor* by Lesueur, and it is the same that is described and figured in Mr. Herbert's (Frank Forrester's) work, under the name of "great northern pickerel," *(Esox lucioides,)* and in Mr. Norris's as the "great lake pickerel." Cuvier and Valenciennes, in their great work on fishes, had correctly described and figured it as *Esox estor*, and, indeed, were able to avail themselves of typical specimens sent to them by the original describer, and agreeing, in all respects, with the original description. The species is very distinct from any other American form, and at once recognizable by the whitish, roundish or oval spots scattered over the darker ground color. It is, too, the only species that has the cheeks entirely covered by scales, while the lower half of the operculum and the suboperculum are naked. It is generally distributed throughout the great lake region, as well as the St. Lawrence river and Lake Champlain, and in the St. Lawrence is most generally known as the "channel pickerel," while in the Lake Champlain region it appears to be more especially known under the name of pike or pickerel; the name muskellunge, however, being frequently employed for it, as already remarked. As everything that has been said respecting the habits and quality of the English form is applicable to the present, reference need only be made to such accounts.

Superior to the true *Esox estor* in size, as well as in quality as food, is the species described and illustrated under the designation "mascalonge," *(Esox estor,)* in the works of Messrs. Herbert and Norris. The species was first made known by Dr. (afterwards Sir John) Richardson, and erroneously described as *Esox estor*, and this error has probably been the cause of the persistent retention of the name for the species in popular works. The proper name, however, is *Esox nobilior*, given by Dr. Thompson, in allusion to its superiority in size and excellence as food. The vernacular name, muskellunge, seems to be more especially employed for it. The species is readily distinguished among its congeners by its coloration, which consists of a dark greenish, tinged with steel-blue on the back, and relieved by roundish or oval *darker spots;* the abdomen is bluish-white; the fins, likewise, are mottled with dusky spots. Like the *Esox estor*, the lower part of the operculum and the suboperculum are naked, and even the cheek is naked at its lower portion—a feature peculiar to itself. It may be added that it has also more numerous branchiostegal rays (18–19) than any other species of the genus. It sometimes attains a weight of more than fifty pounds. So far as known, its habits are similar to those of the *Esox estor*, and its geographical area, or habitat, is apparently nearly coincident with that of the latter; it has not, however, been found so far westward. The superiority generally awarded to it, as an article of food, might well justify any attempts to introduce it into large bodies of water, especially such as are already stocked with the inferior *Esox estor*. It has been recommended by British pisciculturists for introduction into their own waters.

Of the smaller species—those having the sides of the head wholly scaly—the common pickerel of the east *(Esox reticulatus)* first demands notice. This species is very generally distributed throughout the New England and middle, and, at least, the northern seaboard States of the south. It is readily distinguishable by the pattern of coloration—dark, mostly longitudinal, lines anastomosing and forming a kind of net-work on a greenish-brown, generally yellow-tinged, ground; to this peculiarity of coloration the specific name *(reticulatus, i. e.,* net-like) refers. Additional distinctive characters are found in the number of rays, there being generally eighteen (17–19) dorsal, seventeen anal, and fifteen (14–16) branchiostegal rays. In habits it resembles its congeners, its voracity being only less in proportion to its size. It is, like its relatives, readily domiciliated; and those who are willing to endure the sacrifices which its introduction would entail, would find no difficulty in its propagation.

A southern form, occurring in South Carolina, has been separated from the *Esox reticulatus*, under the name of *Esox affinis*.

In addition to these, there are several species of pike or pickerel, smaller than any of the preceding, marked with blackish cross-bands, often more or less interrupted, and inclining somewhat forwards. They have, generally, only twelve or thirteen (rarely fourteen) branchiostegal, fourteen to sixteen dorsal, and fifteen or sixteen anal rays. The best known of these is the species described and figured in the recent works on our game fishes as the Long Island pickerel, or *Esox fasciatus*, Dekay. It had, however, been several times described before Dekay bestowed on it his name, and is by no means confined to Long island, but is quite generally distributed through the New England and middle States. It rarely equals a pound in weight, and is said to be little destructive—a character which it doubtless owes to its small size, as its propensities must be similar to those of its larger kindred. In the south, this species is represented by the *Esox Ravenelii*; in Pennsylvania and the west, by the *Esox umbrosus* and *Esox cypho*.

Although several other species of Esocids have been described, they are but little known, and must be passed over in silence. It has been deemed proper to devote this much of time to the consideration of the more common species, because they have more than usual interest for the sportsman and fisherman, and their relations and names have been by no means satisfactorily exposed in the existing manuals of angling.

Salmonids.—Although, in many respects, the most interesting of fishes, little will be here said of the Salmonids, as, on account of the interest they have excited, and the attention consequently paid them, they and their habits are better known than almost any other fish, and information respecting them is both abundant and readily accessible. It is, indeed, their propagation which has chiefly interested pisciculturists, and a large part of the literature of pisciculture is devoted to the consideration of the propagation and dissemination of the salmon and trout. I shall here, therefore, restrict myself to a few remarks having reference to the relations of genera to the family, or in correction of erroneous statements current in popular manuals.

Every one is familiar with the form of the salmon and trout, and they are typical representatives of the family—all offering the same general form Their body is covered with scales which have, generally, entire edges. The head is scaleless, the suborbital bones moderate and not covering the cheeks, and the margin of the upper jaw is formed by the intermaxillary bones in front, and on the sides by the maxillary. With these characters is also always associated a small adipose or fatty dorsal finlet, situated far behind. But the adipose fin has not that value as a distinctive character which has been claimed for it, as not only the catfish of the United States, but peculiar fish of rather small size, having some superficial resemblance even to the Salmonids, but very widely differing from them, also have it, and it is common to several other types represented elsewhere. Fishes closely related to each in other families are differentiated likewise by the presence or absence of such a fin, the European catfish, for example, having no such appendage.

The family thus limited is almost entirely to the Arctic and north temperate regions. A single aberrant form, remotely allied to the smelts and capelins, (*Retropinna Richardsonii*,) inhabits the seas of New Zealand, and it has been positively affirmed that a trout named *Salmo gracilis* inhabits the river De la Mana, of Guiana, and that a specimen was sent thence to the Museum of Natural History, at Paris; but notwithstanding the positive statement as to the last, there is still cause for doubt as to its correctness, and that habitat, at least, needs confirmation.

The Salmonids are naturally grouped in several divisions, characterized by structural peculiarities which are coincident with features which the eye seizes, but which have not always been recognized in the exposition of their systematic relations.

Salmonines.—First and foremost wehave the typical Salmonids, or sub-family of Salmonines. In these, the form, as well as the position of the fins, is essentially the same as in the trout and salmon. The stomach is continuous with the œsophagus, and behind has no cœcal prolongation, but is simply curved forward and defined by a strangulation at the pyloric extremity, behind which numerous* slender cæcal diverticula of the intestine—the so-called pyloric cæca—originate from around the intestine. The teeth are acutely conic, but vary extremely in size as well as in presence, and may, indeed, be said to be absent in some. The sub-family, as thus defined, embraces the genera *Salmo*, (the salmon and trout,) *Thymallus*, (the graylings,) and *Coregonus*, (the white-fish,) as well as several closely related to those types, but distinguished by minor differences. All the representatives of this group are either permanent inhabitants of fresh waters or resort to them to breed.

Plecoglossines.—A very peculiar form (*Plecoglossinæ*) may here be noticed, as it has been approximated to the Salmonines, although exhibiting some very strange characteristics. A single species is known, and has only been found in the seas of Japan and Formosa. It has the general form of the salmon as well as arrangement of the fins, but is distinguished by its remarkable dentition. The teeth are minute on the intermaxillary bones and on the tongue, which organ is very small, but the teeth of the maxillary and lower jaw are wide, truncated, and lamelliform, inserted in folds of the skin and movable, and themselves lamellated and serrated. The pyloric cæca are excessively fine and numerous. It is a small fish, of no great economical value, and has been named *Plecoglossus altivelis.*

Argentines.—The smelts and capelins form another tribe, (*Argentininæ*,) and are distinguished by having a stomach terminating behind in a cæcal prolongation and the presence of comparatively few cæca† (6-12) around the pylorus. The branchiostegal rays are also comparatively few, and the species are of small size, chiefly inhabitants of the sea; but some (the smelts) ascend rivers, and even live in fresh-water lakes. The color of most species is a brownish or greenish silvery. Although several of the species are excellent as food, they scarcely merit the attention of the pisciculturist, except, perhaps, in case of the smelt, (*Osmerus.*) It would, however, be desirable to secure the capelin (*Mallotus villosus*) from the ruthless destruction to which it is exposed in the British colonies.

We may only pause to add that of the salmon alone nearly fifty recorded species are found in the fresh waters and the seas of North America, although some species may yet have to be degraded to the rank of simple varieties of older-known types. These belong to the genera *Salmo*, *Trutta*, *Hypsifario*, and *Oncorhynchus*. The last named genus comprises a number of species inhabiting the seas of the north Pacific, and ascending the rivers of northwestern America and Siberia in the breeding season. They are large species, like the salmon, and distinguished by the excessively hooked jaws of the males in the breeding season, as well as by the increased number of rays in the anal fin, (15–18.) The whitefish represent two genera, one (*Coregonus*) distinguished by the small mouth and projecting snout, and the other (*Argyrosomus*) characterized by a larger mouth and projecting lower jaw. The species of the latter are, in some places, especially in the great lake region, known as "herring." Two other genera are much more confined in their geographical distribution; one, embracing the gray-

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* The graylings have cæca in exceptionally small number, comparatively.

† In one form (*Silus Ascanii*) there are sometimes as many as twenty small cæca.

lings, (*Thymallus*,) is common to America and Europe, but the American species, although several in number, are rare and scarcely known, contrasting strongly with the congener of Europe, which, although likewise limited in distribution, enjoys great celebrity as a game and savory fish. Report gives the same high character to one of the American species, (*Thymallus signifer*,) but this is a species confined to the high northern and little accessible regions between Mackenzie's and the Welcome rivers. The other species, found in Lake Ontario and the State of Michigan, have not been reported on as to their game or edible qualities. The second genus, to which the name *Stenodus* has been given, embraces a species of the Mackenzie river, well known to the inhabitants and travellers of that region as the "inconnu"—the *Stenodus Mackenzie* of naturalists.

Cyprinids.—Of this family, the carp and gold-fish, as well as the shiner, dace, roach, &c., are examples. They are familiar to all, and, as they have little to recommend them, in a practical point of view, must be passed over with little notice. Few species of the family found in the United States, on this side of the Rocky mountains, attain the large size which many of the European species reach; but on the western slope, where they are the chief fresh water fishes, they rival or surpass their European relations in size, and are of economical value. Of the eastern species, those of *Semotilus*, generally known under the names of "wind-fish," "chub,"* &c., attain a goodly size, and furnish much sport to the angler. The shiners, dace, &c., are favorite subjects for the exercise of juvenile skill in angling.

One of the European carps has been successfully domesticated in this country; and, if it is simply desired to possess a fish that will live almost anywhere, feed on vegetables and refuse, and is of a peaceful disposition, will grow rapidly and attain a moderate size, all the conditions are offered by this fish. If, however, one of delicate and savory quality is desired, this will be found to be deficient; and, as in Europe, the most important part of its preparation for the table will consist of the sauce in which it is served.

The gold-fish (*Carassias auratus*) is well known as an ornament of the parlor and drawing-room, and of small ponds; it, too, has been domesticated, and is abundant in the vicinity of most of the older cities of the country.

Space forbids attention to the hosts of small species of this large family found throughout the country, as most of the species are of no practical value, and scarcely merit the attention of pisciculturists.

Silurids or cat-fishes.—The family of Silurids or cat-fishes is a very large one, embracing species found within the seas and fresh waters of almost all temperate and tropical countries. Europe, at least in its central and western regions, has only a single species—the *Silurus glanis*—which is not found in the British islands. But in North America, almost every stream and pond is inhabited by species, and they are among the most characteristic of our fishes. They belong to a peculiar group, very distinct from that of which the European species is the type. All in this country have a moderately elongated body, the anal fin long, but entirely separated from the caudal fin, an adipose dorsal fin, and the head has eight barbels—two originating behind the posterior nostrils, four below the chin, and the two very long, characteristic ones, terminating the maxillaries, and issuing from the corners of the mouth. The roof of the mouth is unarmed, or destitute of teeth.

The numerous species embraced in this group are distinguished among themselves by secondary characters which have caused their combination into four

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* These names, however, are very indiscriminately applied, and are very often fastened on entirely different species. The sun-fish, for example, shares the name "bream" with a cyprinid, and the name chub is indiscriminately applied to the fish here noticed and a species of sucker (*moxostoma oblongum*.)

subordinate groups or genera. One *(Amiurus)* is known by its large head, covered with a thick skin, and its comparatively short, obese body, and broad, rounded, or squarish caudal fin; to this belong the common catfishes of the Eastern and Atlantic States, *(Amiurus catus, A. Dekayii, A. atrarius,)* and several related species inhabiting the west and the Mississippi basin.

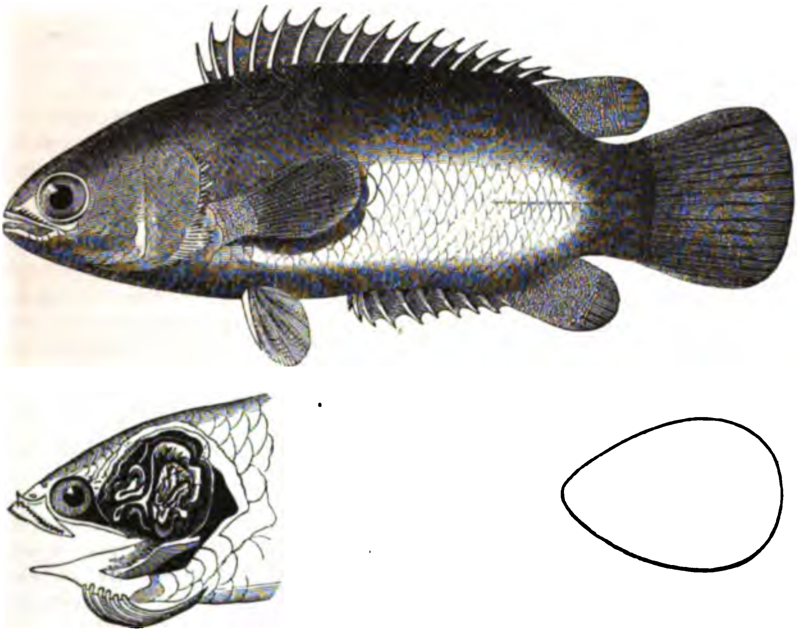
Related to these are species with a smaller, neater, and less flattened head, the skin of which is thin, and does not conceal the bones, and which, moreover, is connected by an immovable bridge with a flat bone—the head of the interspinals—in front of the dorsal fin; the body is slender and rather elegant in shape, and the caudal fin is forked. To this belong the "blue," "silvery," and "channel-cats" *(Ictalurus cœrulescens,* &c.) of the Ohio and Mississippi basins, and the great lakes. The species attain a larger size than the others, some weighing as much as one hundred and fifty pounds, or even more, it is said. They are also much superior to the others as food.

A third form is peculiar to the Mississippi basin, and is distinguished by the flat, oblong head, the much longer body, fine teeth, and nine ventral rays; the skin has a peculiar unhealthy appearance, and is thick. The species is called "mud-cat," at least in Ohio, and is not esteemed for food, perhaps rather on account of its disgusting appearance than for any sound reason. The scientific name is *Hopladelus limosus.*

A fourth genus *(Noturus)* comprises the species known as "stone-cats," and which are the objects of considerable fear to many, on account of the severe wounds which they can inflict. They may be recognized by their depressed oval head, with a cross-like crease behind at the nape and the middle of the head, and especially by the long, adipose fin almost, or quite, united to the caudal, and by the eel-like form of the latter. The spines of the fins are short, acute, and not serrated, and inflict the dreaded wounds. Species are found in most of the States, except the north and northeast, but are rather rare; they have no economical value. The species of the east is *Noturus gyrinus;* that of the west, *N. flavus;* and that of the south, *N. lemniscatus.*

Although the cat-fishes are rather despised by many, they are by no means the most contemptible fishes as food, and the channel-cats have really superior merit; and there are many ponds which now only nourish eels, and species of no value, in which they might readily be introduced, for cat-fishes will thrive where others would die, and it may be assumed that, wherever eels will live, cat-fishes will. The European cat-fish, or the "wels" of the German, is generally highly esteemed; and fishes not very remotely related to these—the cascaduras of Trinidad and South America *(Callichthys* and *Hoplosternum* sp.)—are so highly esteemed that, in the island mentioned, their excellence is intended to be expressed in the saying, that "he who eats of the cascadura will die in the island." As the cat-fishes are very tenacious of life and hardy, it will be sufficient to introduce a few pairs in a pond which it is desired to stock, and they will doubtless be able to take care of themselves, and, if favorable breeding grounds are offered, will multiply. The habits of the fishes are very interesting, and I have, for hours, watched the old, with young swimming round in a dense cloud, and gradually moving off from shallow to comparatively deep water. The old are assiduous in the care of their young.

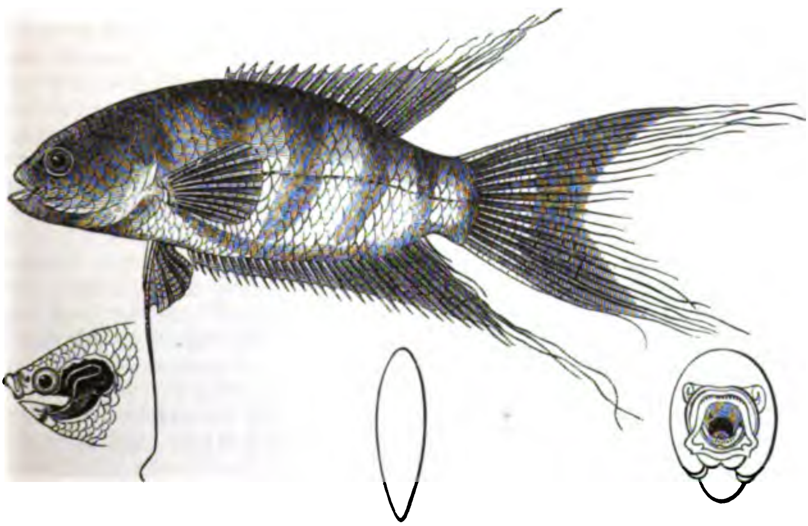
Other Fishes.—Thus have we passed under review the American fresh water fishes which most merit the attention of the pisciculturist. Did space allow, an inquiry into the merits of others might be interesting; but as none are pre-eminent for the excellence of their flesh, we pass them by in silence. We may only recall that the eels have been the subject of much attention on the part of European pisciculturists, and waters in which better species cannot be advantageously introduced would easily support. The Buffalo perches, (*Haploidonotus grunniens,* &c.,) the Etheastomids, the Percopsids, the Cyodortids, the Umbrids, the Cypri-



(Figure 8.)

ANABAS SCANDENS. (*Cuv. et Val.*)

"CLIMBING FISH."



(Figure 9.)

MACROPODUS VIRIDI-AURATUS. (*Lac.*)

nodonts, the Catastomids, &c., must, for the same reason, be passed by with total neglect.

THE GOURAMI.—ITS HABITAT, OR NATIVE COUNTRY.

Among foreign fishes, none has excited so much interest, in an economical point of view, or has been the subject of so many attempts at acclimatization among the French, as the celebrated *Gourami*—the *Osphromenus gourami* of naturalists.* A somewhat extended notice of its peculiarities and relations to other fishes, its habits, and of the attempts made to acclimatize it in France and her colonies will, therefore, doubtless be acceptable.

The native home of the *Gourami* is the fresh waters of the Malaccan islands—Java, Madura, Sumatra, and Borneo; and from the inhabitants of those islands we derive the name as well as the fish itself.† It has been attributed as a native to China, but erroneously. It has been introduced into China, however, as well as into Pinang, Malacca, Mauritius, Reunion or Bourbon, Martinique, and Cayenne. The Gourami attains a very large size, and reaches, *it is said*, five or even six feet in length, and a weight of more than 110 pounds. It may be readily understood, however, that it attains these large dimensions only under very favorable circumstances, and fish of twenty pounds weight are not very common.

The *Gourami* belongs to a family of fishes which has always provoked interest by the singular adaptations for holding supplies of water in peculiar reservoirs or organs developed from the first of the gill arches, and which has obtained for the family the name of fishes with labyrinthiform "pharyngeals," or Labyrinthici. Like other bony fishes, the *Gourami* and its kindred have four cartilaginous arches, and each of these bears on the external or convex edge a gill which is double, or composed of two leaflets; behind these arches are two somewhat flattened bones, contiguous at their internal edges, and bearing minute teeth, called the lower pharyngeal bones, and above, connected with the ends of the posterior gill arches, are other flat teeth-bearing bones known as the upper pharyngeals—these, too, are shared with most fishes; but in addition to these, a peculiar superbranchial organ is developed from the third or terminal portion, or articulation of the first branchial or gill arch; this organ is composed of thin, more or less expanded laminæ, or leaflets, which form more or less complicated chambers or cavities. These chambers receive and contain a supply of water which furnishes sufficient to moisten the gills and enable them to perform their functions of aerating the blood long after the fish has been isolated from the water; this structure is also associated with contracted branchial apertures or gill holes, while the gill covers are closely appressed to the shoulders, and the fish is thus enabled still better to eke out its supply of water. As a consequence of this beneficent provision, we find that the fishes of this family are enabled, in an extraordinary degree, to sustain deprivation of water, and that some at least can leave the waters, or the places now dried up which they have inhabited, and travel on land for some distance, to seek more favorable resorts. It is to this family that the celebrated climbing fish of the East Indies *(Anabas scandens)* belongs; and to this same family equally belongs the *Pla Kat* of Siam, *(Betta pugnax,)* which is raised by the Siamese for game purposes, individuals of the species being pitted against each other, and fighting with as much vim and animosity as their warm-blooded rivals, the game-cocks. Still another species (the

* This species is also known as the *Osphromenus olfax*, but the prior name is that here adopted.

† The proper pronunciation would be best indicated by *gurahmee*.

Macropodus viridi auratus) is said to be reared for ornamental purposes by the Chinese, like the goldfish, and its beauty is sufficient to entitle it to such a distinction. On account of the interest attached to these fishes, figures on with the climbing fish (*Anabas scandens*) and the *Macropodus*, are here given, and these will give a tolerably fair idea of the extent of variation in the family.

In form these fishes somewhat resemble the Centrarchids, or sunfishes, of our streams and ponds. They differ extremely among themselves in the develpment of the fins; this is especially the case with respect to the dorsal or back fin, for in some it occupies the whole length of the back, while in others, as the *Pla Kat*, it is confined to a short space near the middle; the anal and ventral fins are little less variable, but it would lead us too far to detail such modifications.

Characteristics.—The *Gourami* may be said, in general terms, to somewhat resemble a rock bass or sunfish, but having a smaller head and a still smaller mouth comparatively, a very long anal fin reaching from the breast nearly to the base of the caudal fin, and the ventral fins inserted nearly on a line with the pectoral, the first soft ray being very long, lash-like, and almost or quite equalling the whole length of the fish. There are from eleven to thirteen spines, and an equal number of soft, jointed rays in the dorsal fin, while the anal has from nine to twelve spines, and from nineteen to twenty-one soft rays; the ventral fin has a spine and five rays, the first of which is the elongated one already referred to; the others are short and small. The color of the old is a nearly uniform dark olive green or brown, but the young is ornamented by seven to nine slightly oblique blackish bands crossing the body; at the base of the pectoral fin there is a distinct black spot, and another roundish spot exists on the side of the caudal peduncle in front of the fin and above the lateral line. The jaws are armed with a band of fine teeth; the roof of the mouth is smooth.

The *Gourami*, in its native country, has always been esteemed for the delicacy of its flesh, and Commerson, the traveler, to whom we are indebted for our first precise description of the fish, has in rapture exclaimed that he never tasted, among either salt or fresh water fishes, one more exquisite in flavor than the *Gourami*—"*nihil inter pisces tum marinos tum fluviatiles exquisitius unquam degustavi.*" In such esteem is it held, that the Dutch colonists at Batavia are said to keep them in very large earthen jars, removing the water daily, and feeding it with aquatic plants or herbs, and especially the one called *Pistia natans*, a species belonging to the *Araceæ* or Arum family.

In a state of freedom, the *Gourami* lives, by preference, in warm, still, or stagnant and somewhat muddy waters. It is very sensitive to changes of temperature, and even in the island of Bourbon retreats in the winter toward the bottom of the ponds where the water is warmest, and burying itself in the mud, if present, seems to remain in a torpid state while the cold lasts. The greatest heat apparently does not incommode it, and in summer it ascends to the surface of the water, basking in the sun, and, often protruding its mouth above the water, swallows the atmospheric air.

While the *Gourami* is essentially a vegetarian, and its diet is indicated by the extremely elongated intestinal canal, which is many times folded on itself, it does not confine itself to any special plants, nor, indeed, to the vegetable kingdom, for its supply of food, and on account of its miscellaneous feeding has obtained from the French the epithet of *water pig, or Porc des riviers.* Besides the leaves of the *Pistia* already mentioned, and all other species of araceæ which it seeks with avidity, it will eat cabbage, radish, carrot, turnip and beet leaves, lettuce, and most of the wild plants which grow in the water, nor does it refuse earthworms, frogs, or even cooked meats.

In its movements, the *Gourami* is usually slow, swimming leisurely and majestically along, and takes its time in making its meal; it is, however, capable of rapid movements, and when frightened or disturbed, will dart away with great

swiftness; when first confined in narrow quarters, it will also attempt to escape by leaping out of the water. It will take the hook baited with worms.

In its sexual relations, and the care which it takes of its eggs, it somewhat resembles the sunfishes of temperate North America and the Cichlids of the warmer portions of the continent and of Africa. In spawning time, the males and females pair, and each pair select a suitable place and construct a rude nest. "Like all intelligent animals, it will only propagate when it is insured a suitable temperature for its eggs and young—a fit retreat wherein to build its nest, with vegetation and mud to make it, and the aquatic plants suitable for the food of the young. The bottom must be muddy, and the depth variable; in one place at least a yard, or metre, and convenient to it, several metres deep. It prefers to make its nest in tufts of the grass called *Panicum jumentorum*, which grow on the surface of the water, and whose floating roots, which rise and fall with the tide, form natural galleries, under which the fish may conceal itself." In one of the corners of the ponds, among the plants which grow there, the *Gourami* attaches a spherical nest, composed of plants and mud, and resembling in form those of certain birds.

These nests are about fourteen centimetres, or between five and six inches, in length; the male and female labor assiduously in its construction, and continue their toils till it is completed. In five or six days, or a week at furthest, it is finished. This aptitude of the *Gourami* to make a nest is facilitated, when the pairing season has arrived, by placing in the water, almost at the surface, a large branch of bamboo, (*Bambusa arundinacea*, Wild.,) to which are attached bundles of fine dog's-tooth grass. The *Gourami* takes this grass and forms with it its nest in the branches of the submerged bamboo, in the same way that the silk-worm avails itself of the branch which is presented for it to make its nest on. Toward the end of the months of September and of March, in the island of Bourbon, propagation takes place. The nest made, the female deposits its eggs, of which there are from about 800 to 1,000. After the eggs have been deposited, and while they are becoming matured, the parents remain near the nest, prepared to drive away intruders.

The eggs are soon hatched, and the young then find in their nest "a refuge where they are free from a thousand dangers which would threaten them for the first days of their life. Besides, they find in the macerated vegetable matter, which partly composes their nest, their earliest food, and which is most suitable for their delicate condition. Soon afterwards they make short excursions from the nest under the guidance of the mother fish, who is prepared to give them aid in case of need. They do not disperse, but keep together in bands. The young still retain the yelk-bags, which trail behind like two long appendages from below the anterior portion of the belly, and seem to assist them in maintaining their equilibrium."

The rate of growth is not rapid, and at the age of three years, the fish is only about nine inches, or twenty-two centimetres, long; but at that age it is said to be able to propagate its race. Those kept in vases or small ponds are still slower in their growth, which is even arrested at a comparatively small size. The small fishes are most esteemed as food. Their flesh, it may be added, is firm, and of a pale straw or yellowish color.

Attempts to acclimatize the Gourami.—In such esteem has this fish been held that none, save the goldfish, has been the subject of more exertions to acclimatize in different countries, and if we literally accept the word *exertion*, even the goldfish cannot be excepted, for, although it is true that that species has been more generally introduced into foreign waters, little or no exertion seems to have been necessary to effect that object. The history of the attempts and success in the acclimatization of the Gourami may not only be useful with reference to eventual efforts to introduce it into the United States, but the experience gained

ay be of advantage in the treatment of others. A somewhat extended narrative, impiled from the writings of Cuvier, Rufz de Lavison, Auguste Vinson, and hers, is therefore submitted.

As already remarked, the *Gourami* is now found in southern China, but has ;en probably introduced into that country, although the date and circumstances its acclimatization are unknown to us. It has likewise been introduced into me of the islands of the same archipelago and near those of which it is a ıtive. But the history of its introduction into the dominions of the French in fferent quarters of the world is better known and of greater interest.

The first effort on the part of the French of which we have knowledge was ade in 1761, when several naval officers—chief of whom were Captains e Surville, Joannis, and De Magny—took some fishes to the Isle of France or auritius, but, it is said, rather for the gratification of the sight and for exhibition vases than with reference to its eventual naturalization in the island. M. De éré, who has been accredited with the introduction of the goldfish into France, ıd who was at the time mentioned commander of the French troops in the land, also interested himself in the introduction of the species. Individual fish aced in ponds propagated; some escaped into the contiguous streams, and e species had become already domiciliated in the island when Commerson, the ıturalist traveler, visited it in 1770.

The Gourami was next introduced into the neighboring island of Bourbon or eunion in 1795, at first through the efforts of M. Desmaniéres, a resident of the land, and who imported specimens from Mauritius; but his example was soon llowed by others. His experience has been given by Mr. Vinson, and, on count of its important bearing on the subject of its acclimatization in other nds, is repeated in his own words. M. Desmaniéres had, "on his estate of ellevue, situated on the upland of the quarter Sainte-Suzanne, a magnificent ıtural body of water with two islets abounding in aquatic plants. Everything)peared to be propitious for the raising of the *Gourami*, but the low temperature this part of the island had not been taken into consideration. The fishes ved, but did not propagate. M. Desmaniéres at first thought that the large ze of the pond might be the cause of this, and he had made two vivaria, which ay yet be seen, and which were supplied by the large pond. In these vivaria e *Gouramis* were placed, but the result was no more fortunate. He received om the Isle of France additional fishes, but still had no success. Finally, having ansferred his fishes into a vivarium near the sea-shore, he succeeded in inducing opagation. This experiment had, however, taken thirty years, and during is time, success in propagating the species in the island had become despaired . As has been seen, acclimatization often depends on causes very simple in)pearance, but which are only discovered after a long time. Since the period ımed, the fish has been widely spread through the island," and is now abundant.

The next earnest attempt to introduce the species into a distant country was ade at the instance of M. Moreau de Jonnes, who, in 1818, induced the "minter of marine" of France to order the transportation of specimens to the French)ssessions in the West Indies. Accordingly, in April, 1819, a hundred small shes were intrusted to the care of M. De Mackau, captain of a store-ship—*Lc olo*—and the interest and zealous care manifested by that officer were rewarded y the comparatively slight loss of only twenty-three fishes during the entire)yage to the West Indies; and when it is recalled that a slight blow, an abraon of the sides, or loss of a scale may cause death, and the difficulty of adjustg the supply of fresh water, &c., to their necessities is taken into consideration, ıe small percentage of the lost must be considered as remarkable. Of the venty-seven which remained alive, twenty-six were distributed to the islands Martinique and Gaudeloupe severally, and twenty-five to the colony of Cayıne. The fortunes of the strangers in their new places of abode were various.

Cuvier and Valenciennes, in the seventh volume of their "Histoire Naturelle des Poissons," published in 1831, acknowledge the reception of one of the fishes originally taken from Isle-de-France to Cayenne. The belief that their acclimatization in America had succeeded has even found utterance in the statement as a fact which has obtained currency in several publications. Although the fishes introduced continued to live, none seemed to be fruitful in their new quarters, and there is no published evidence that any individuals of the species are now living in America. We have the fullest and most authentic details concerning its fate in Martinique.

The little fishes, on their arrival at Martinique, were placed in a large basin of fresh water; the largest of them was only about three French inches long. Some months after, they were transferred to a small pond in the botanic garden of Saint Pierre; all were still alive and healthy, and had attained a length of from ten to twelve inches. Their subsequent increase was, however, much less rapid, and nearly six years were required to little more than double that length, for in 1827 the largest had only gained a length of from twenty-four to twenty-seven inches. The subsequent rate of increase was still less rapid, as might naturally be supposed; and the last survivor of the original twenty-six, which was served on the table in 1846, twenty-seven years after its arrival at Martinique, measured about a metre or somewhat more than thirty-nine inches in length. None of these fishes had been able to propagate their race in the island during all this time. Five years after their introduction, a formal announcement was, indeed, made that numerous young *Gourami* had made their appearance in two broods, at intervals of only six months, but it was soon discovered that the supposed young *Gourami* were native fishes that had gained entrance into the preserves of the *Gourami*. The sudden revulsion from the hope and high expectations to which the apparent success had given rise, to chagrin and despair, unhappily reacted on the poor fishes, and was doubtless enhanced by the ridicule which the exposure of the nature of the discovery entailed on the historian of that discovery, and which engendered a proverbial expression in the island. The prospect of propagating the *Gourami* appearing hopeless, one after another was caught and served up on the table of the governor when a distinguished guest was to be entertained, and thus was the last disposed of in 1846. Although equally full details have not been published concerning those introduced into Guadeloupe and Cayenne, no greater success appears to have rewarded the attempts to propagate the species. As to the latter, it has recently been stated that the fish known as *Connani* is the same as the *Gourami*, and occurs abundantly in the rivers of Guiana, but the *Connani* is evidently an entirely different fish, and even a member of a very distinct family.

Repeated attempts have been made in recent years to introduce the *Gourami* into France, Algiers, and Egypt, but the fishes have either died on their way to their respective destinations, or have survived for but a short time their introduction into the new waters; a sudden diminution of the temperature has proved disastrous in its results to them, and the greatest care and precaution are necessary to protect them from the changes of the weather. The last attempt to introduce the *Gourami* into France which has come to the knowledge of the compiler was made in the spring of 1865. Nineteen young fishes, in a glass vase, were consigned to the steamer running between Mauritius and Suez, which left the former place on the 20th of March. All survived the perils of the voyage as far as Alexandria; but on the route from that place to Marseilles, where a comparatively low and unequal temperature prevailed, eight of them died. Of the eleven that arrived in safety, one other died the following night; but the fate of the rest has not been recorded in the French periodicals yet received at Washington.

Eleven young *Gouramis* were also safely transported, in the autumn of 1864, from the island of Mauritius to Algeria, but their fate is likewise unknown.

Attempts have been made to introduce the species into Egypt; but the results, so far as known, have not proved favorable.

The interest excited in the *Gourami*, and the attempts to acclimatize it, have not been confined to the French. The English settlers of Australia and Tasmania have endeavored to introduce the species into their waters, and individuals have survived the voyage to those distant countries. At Victoria, Melbourne, and Hobartstown, there are acclimatization societies which have undertaken the introduction, into their respective districts, of desirable plants and animals; and of the fishes, the *Gourami* has been one of the most sought for. Individuals of that species were secured for Victoria, through the exertions of a merchant of the town, but the history of the undertaking is unknown. At Melbourne, after unsuccessful efforts, the Society of Acclimatization finally received, from Mauritius, eighteen living fish, out of a total of thirty that were embarked for that place. No accessible record exists of its introduction into Tasmania.

The impracticability of naturalizing it in cold countries.—Such is the history of the more prominent attempts to introduce the *Gourami* into foreign waters. The narrative will readily demonstrate that its acclimatization in even warm temperate countries is by no means easy; and the natural inference, resulting from a study of the fate of those efforts, is that it will be useless to attempt its domiciliation in countries where the temperature in winter is sufficiently low to allow ice to form on the streams. If, therefore, it is desired to introduce the fish in the American waters, the attempt must be made in the southern States, and in warm and protected pools or ponds. It will be doubtful whether it can be propagated even there at first, and the habits of the species must be still more closely studied in order to ascertain why it should have proven sterile in the West Indian islands and Cayenne. It cannot have been on account of want of sufficient heat, for the mean temperature is not very different from that of Mauritius; nor can it be due to the difference in time of the seasons, for the species has been successfully acclimatized in China, which is north of the tropics, as well as in Mauritius and Reunion. The cause of sterility is, therefore, at present inexplicable; but when it is known, it may perhaps be counteracted. It would appear to be extremely doubtful whether the species can be introduced and reared in France; but yet it must be remembered that so eminently experienced and scientific a man as M. Coste, the academician, has pronounced the opinion that it can be effected, and he has published instructions to guide those to whom carriage of specimens may be intrusted. Possibly by persistence of effort, and by selection of hardy individuals for stock, success may eventually be attained; and if such can be had for France, there seems to be no reason why like fortune should not be expected in the United States, as far north as the latitude of Virginia. Doubtless, the fish would be a very valuable acquisition if it could be reared, and the more so as it is herbivorous, while the most esteemed fishes, found in the more temperate regions of the United States, are more or less carnivorous.

Rules for transportation and introduction.—As to the introduction, it would, probably, be more readily effected by the transportation of nests with the ova, than by that of the fishes themselves, and such a course would at least require less care and attention, and would have the additional advantage of furnishing so many more individuals to select from. If, for any reasons, it is preferred to experiment with the young, the smallest should be chosen, and they should be placed in wooden or earthenware vessels; the latter would be preferable, and those having a capacity of from ten to fifteen gallons would perhaps be best, but tubs or casks, when perfectly clean, may be used. The receptacle, whatever it may be, should be suspended, in order to avoid the disturbance of its contents by the incessant rolling of the vessel, such motion being prejudicial to the welfare of the fishes. The fishes should also be fed, and a supply of suitable plants

should, therefore, accompany them. I may conclude with a translation of the specific instructions of Mr. Coste, from whom, indeed, I have derived the hints above offered:

"1. Very young fishes should be selected.

"2. These fishes should be distributed among several receptacles.

"3. Care should be taken not to crowd too many together in one receptacle.

"4. The water should be renewed partially or entirely whenever it becomes necessary.

"5. It should also be aerated from time to time.

"6. The fishes should be fed whenever they shall seem to require it.

"7. The remains from the food which has been given to the fishes should be carefully taken up from the bottom of the receptacle, and removed within eight hours after feeding; the dejections and other impurities which would injure the water should also be removed.

"8. Finally, the several receptacles should be kept in different places, and under various conditions."

MARINE PLANTS—THEIR USES, WITH A BRIEF ACCOUNT OF THE CURING OF IRISH MOSS.

BY G. HUBERT BATES, SCITUATE, MASSACHUSETTS.

SEA-WEEDS, or marine algæ, are of the cryptogamic division of plants, flowerless, having their fructification concealed. They are cellular plants, found in the shallow parts of the sea all over the world, consisting of a brown, red, or green thallus, sometimes stalked, which bears the organs of fructification. These consist of antheridium cells, containing phytozoa, and of others containing germinating spores of different kinds. These organs of reproduction are often united in the same conceptacle. In other cases, they are on different parts of the same plants.* The spores sometimes have moving cilia, and are called zoospores; at other times, four are united, so as to constitute tetraspores, as in the plant *Chondrus crispus*, Irish moss.

In some of the filamentous algæ there is a conjunction of two cells, so as to produce a spore; in others there is a fissiparous division of cells. Many of the lower algæ approach so nearly to the lowest animal forms that the line of demarcation is formed with difficulty. Some authors give many *Diatoms* a place among the Algæ, while others wholly reject them.

There are three colors of algæ—grass-green, olivaceous, and red. The order has been divided in the following manner: Sub-order 1. Melanospermeæ, or Fucacéæ, brown-colored sea-weeds; marine plants of an olive-green or olive-brown color, consisting of multi-cellular fronds, which assume a thalloid or filamentous

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* Cyclopædia Britannica.

form. The species of this sub-order best known and most valued on our coast are *Laminaria digitata*, called kelp, and *Fucus nodosus*, or pod rock-weed. Sub-order 2. Rhodospermeæ, or Ceramiaceæ, rose-colored sea-weeds; marine plants of a rose-red, purple, or purplish-brown color; leafy, cylindrical, or filamentous. *Chondrus crispus* is an example. Sub-order 3. Chlorospermeæ or Confervaceæ, green-colored sea-weeds; uni-cellular or multi-cellular marine or fresh-water plants; the cells contain a green, rarely purple, or red endochrome. *Ulva latissima* is a well known species.

Many of the marine algæ supply nutritious matter, and are used as food. Species of the *Rhodomenia*, (dulse,) *Chondrus*, (Irish moss,) *Ulva*, (sea lettuce,) *Laminaria*, (tangle,) *Alaria*, *Iridæa*, *Porphyra*, (laver,) and *Gelidium*, may be noticed. The edible nests formed by swallows in China have been supposed to be made of portions of gelatinous sea-weeds. *Chondrus crispus* and *C. mammilosus* receive the name of carrigeen or Irish moss. Their fronds consist, in great part, of a substance somewhat allied to starch, called bessaria, which is extracted by boiling in water. *Rhodomenia palmata*, the dulse of Scotland, dillisle of Ireland, and *Saccharina fucus* of Ireland, is consumed in considerable quantities in the north of Europe. *Porphyra lacrimata* and *vulgaris* are stewed and brought to the tables, as a luxury, under the name of laver. *Ulva latissima*, or green laver, is also used. *Laurentia pinnatifida*, which, from its pungency, is called pepper dulse, and the stalks and fronds of *Laminaria digitata*, called tangle by the Scotch and sea-girdle by the English, are eaten in Scotland; but at the present time the cry, "Buy dulse and tangle!" is rarely heard in the streets of Edinburgh.

In the north of Europe marine algæ also contribute to the support of the cattle. *Fucus vesiculosus*, which contains mannite, a sweet substance, not a true sugar, is particularly relished by them, and they regularly repair to the rocks at low water to feed upon it. As many rock-weeders have perhaps observed, they also relish *Laminaria saccharina*, which contains twelve per cent. of mannite.

In Ireland, Scotland, and the adjacent islands, an article called kelp was formerly largely manufactured by burning *Laminaria digitata*, *L. bulbosa*, *Fucus vesiculosus*, *F. nodosus*, *F. serratus*, and perhaps some other varieties. Towards the latter part of the seventeenth century this business engaged the attention of nearly every inhabitant of the Shetland, Orkney, and Western islands. The noblemen and gentlemen of Scotland owning estates bordering on the sea were generally interested in its production. On portions of the shore where, from the absence of rocks, the plants did not exist, large stones were placed, spores distributed, and in a few months a luxuriant crop of *Fuci* obtained. The thousands of people engaged in the work were not subject to the discouragements of the farmer, for the fuci had no enemies, and the crop never failed.

An account is given by Harvey, showing the rapid reproduction and growth of laminaria. In laying the foundation of a certain light-house, the workmen first cut away the tangle, and finally, in levelling down the rocks, removed every root. Upon the approach of winter the work was suspended, and was not resumed until some six months afterwards, when they were not a little surprised to find the rock again covered with a rank growth of laminaria. This shows the certainty and rapidity of their propagation by spores or seeds.

During the years from 1790 to 1800 three thousand tons of kelp were sometimes made in Scotland in a single season. Kelp is an impure carbonate of soda. The barilla of Spain, manufactured near Alicant, from *Salsola*, (marsh-growing plants,) contains four times the amount of alkali found in the same quantity of British kelp. Kelp was principally used in the manufacture of glass and soap. From the lye of the ashes of marine plants, after the soda has been separated by crystallization, iodine may be procured by means of sulphuric acid.

The value of many species of algæ for manurial purposes is now pretty generally conceded, and great efforts are made by the farmers living near the sea to

secure a share for their lands. The time for hauling this manure is after the occurrence of a heavy action of the sea, which detaches the rock-loving plants from the bottom and urges them, with the help of the usual easterly wind, upon the leeward shore. The deposit in the coves, where the beaches form angles, is often immense, amounting to many hundreds of cords. If the surf does not run too high, the ebbing tide leaves it in a convenient position for the teams which are always promptly on hand, some working night and day, as the tide may serve.

The scene is extremely lively, the teams standing as thick as hacks around a depot, and passing and repassing with the greatest despatch of which they are capable, while the eagerness evinced by the owners in securing this fertilizer is the best possible testimony in its favor. Probably from one to two thousand cords are annually used by the farmers in this vicinity. Mr. E. P. Welch, with two light teams, lately hauled on to his lands, contiguous to the beach, over one hundred cords in five days, while a limited quantity is carried back many miles.

Sea-manure is applied in a variety of ways. Probably the greater proportion is used as top-dressing for grass. This is done either during the fall and winter, or spring, there being advocates for each season, while every one applies it whenever it can be obtained. By some it is composted in the cattle-yard with good results; but those who turn it under at fall or spring ploughing undoubtedly secure the greatest amount of its fertilizing properties. In the application of sea-manure a very marked effect is usually observed. It occasionally fails, however, as a top-dressing for grass; but this rarely occurs upon newly seeded fields. Ploughed in for corn, onions, and cabbage, excellent results are uniformly perceived.

The following analysis will illustrate the manurial value of the various algæ:

Analysis of the ash of three species.

	Laminaria digitata.	Fucus serratus.	Fucus nodosus.
Potash	31.8	30.8	14.3
Chloride of potassum	19.7	6.1	29.8
Iodide	1.3	....	....
Chloride of sodium	23.9	25.8	15.5
Lime	5.3	7.9	7.6
Magnesia	3.4	6.3	5.6
Peroxid of iron	1.3	.2	.1
Sulphuric acid	9.5	17.8	24.8
Phosphoric acid	3.2	2.4	.8
Silica	.05	2.2	1.1
	100.0	100.0	100.0

In Ireland rock-weed is dried, and large loads are carried into the interior. Mr. Boardman, in an article on the Agriculture of Maine, in the Report of 1862, after remarking upon the beneficial effects of rock-weed as a fertilizer in the interior, observes that, "it would not be impossible to suppose that rock-weed, dried and pressed into bales, may hereafter become not only a reliable means of manuring land in the interior of the State, but an item of no small importance in a business point of view." If this were attempted, it would be necessary to gather the sea tangle in boats, as is done in Great Britain in the manufacture of kelp, and cure it during the fine weather of summer; for the storms which wash the deep-water algæ ashore, occur in portions of the year unfavorable for haymaking. Rock-weed, when deposited in any considerable quantity, soon begins

to decompose, larvæ abound in it, even in very cold weather, and an odor arises which is far from being pleasant. I can but conclude that much of its value escapes by allowing it to remain some time in heaps, as many do.

The cellular tissue of sea-weeds is very hygroscopic. If dried, and then exposed to rain, it takes up the water very rapidly. Some of the different species of laminaria have been used as hygrometers. The farmer who places dried rock-weed upon his fields, what, at the time, appears like a moderate quantity, upon the occurrence of rain is surprised at the liberality of the application.

CARRIGEEN OR IRISH MOSS (CHONDRUS CRISPUS.)

Sub-order: Rhodospermeæ, family Spongiocarpeæ.—*Harvey.* The generic name, Chondrus, is characteristic of the substance of the frond, being derived from the Greek word signifying cartilage.

Habitat: Rocks in the sea. Perennial; spring. Root: a disk throwing up tufts of many fronds, which are from two to twelve inches high, very narrow and sub-cylindrical at base, but immediately becoming flat, generally dilating from the base till it becomes three or four lines wide, and then dividing repeatedly and dichotomously, (by pairs,) each division spreading, becoming narrower than the preceding one, and taking place at shorter intervals. The summits are bifid, the segments varying greatly in length, rounded or acute, straight or curved, and often twisted in such a manner as to give the curled appearance denoted by the specific name, crispus. "Fructification roundish or roundish-oval, sub-hemispherical capsules imbedded in the disk of the frond, prominent on one side and producing a concavity on the other, containing a mass of minute, roundish, red seeds." Its color is a deep purple-brown, often tinged with purplish red, paler at the summit, and becoming greenish and at length yellowish-white, as the season advances.

This is the proteus of marine algæ. The varieties are innumerable, and pass into one another so insensibly that it is almost impossible to define them. There is great range in regard to the width of the frond. Whenever the plant grows more or less exposed to fresh water, a still greater change is wrought in its appearance. The main divisions are much broader, fewer, and exceedingly irregular, while the margin and extremity are beset with such a vast number of small segments that the whole suggests the idea of monstrosity. In such specimens the frond, when held between the eye and the light, is thinner, more transparent, and frequently mottled with green. It occasionally happens that the margin is somewhat raised, so as to render the frond slightly channelled, but seldom so much as to allow of its being mistaken for *C. mammilosus.* The pink seeds are very conspicuous when held between the eye and light. When fully ripe, the capsules fall away entirely, and leave the frond full of holes. Greeville concludes his admirable description—parts of which are included in the above—by remarking that "it is difficult, in words, to convey any idea of the variableness of this species."

The varied uses of carrigeen in manufactures make it an article of considerable importance; and the present high prices of glue and isinglass, for which it is an excellent substitute, have created a demand for it heretofore unknown. Up to about the year 1848 all the carrigeen consumed in this country was imported from Ireland, which gave it the popular name of Irish moss. It was collected on the southern and western shores of that island, and was converted into size for house painters, and also esteemed for medicinal and culinary purposes. That imported to America was used in making custards and *blanc-mange,* and sometimes sold as high as seventy-five cents per pound, retail. In 1849 several parties commenced making a business of gathering and curing *Chondrus crispus* at Scituate, Plymouth county, Massachusetts, and produced the first considerable quantity of the domestic article ever sold in Boston. This is still the only point

in the States where any noticeable amount is collected, the business having lately been largely increased, until the annual crop is not far from 500,000 pounds—equal to about 6,000 barrels.

ITS RANGE.

Some sea-weeds are cosmopolitan, and are equally abundant in all latitudes; but generally algæ are more or less local in their distribution, and different marine floras are found in the different parts of the ocean. The degree of exposure to light, and the greater or less motion of the sea, have an important effect. The green algæ occur either in the shallower parts of the sea or in fresh water; the olive-color is characteristic of those sea-weeds that abound between the tide-marks; while the red-colored species grow in the deeper and darker parts of the ocean.

The sub-order Rhodospermeæ, in which Harvey classes the *Chondrus crispus*, seem to flourish in the temperate zone, while Chlorospermeæ increase as we pass northward, and Melanospermeæ towards the tropics. But while *Chondrus crispus* appears, under certain conditions, to abound in the temperate zone, it is generally incrusted with various minute mollusca, that causes its rejection by the dealers. The rocks on the shores of Scituate, in the main, undoubtedly produce the best article yet discovered in this country. But there are ledges here, where the muscle attaches to the plant, that are wholly abandoned by the mossers. Indeed, the range of the clean-growing Chondrus seems to be very limited.

It has been remarked by those who have visited Cape Ann and the eastern shore for the purpose of testing the quality of the moss growing there, that the product of those parts is of a coarse and limy character. Perhaps, however, this moss, in some instances, may be susceptible of improvement. The old plants should first be entirely removed, which would be immediately succeeded by a new growth; and if this exhibits a marked superiority over the old plants much may be expected of the ledge, for each successive "pull" will produce an improvement in the moss. That the abundant moss growing to the eastward has not been fairly subjected to this test, and the improved article brought into market, indicates either a want of knowledge of the necessary process of improving, or the absence of those whose habits would naturally lead them to engage in the business; or it may be that the plant in that quarter is not susceptible of any improvement, as the report goes.

As regards perpendicular direction, Forbes remarks that one great marine belt or zone lies between high and low-water marks, and varies in species according to the kind of coast, but exhibits similar phenomena throughout the northern hemisphere. This is denominated the littoral zone, and necessarily varies according to the rise and fall of the tides. If I am right in my identification, the *Fucus canaliculatus* forms the upper sub-region of this zone, followed by a broad belt of *F. nodosus* and, perhaps, *F. versiculosus* and *F. serratus*. This is succeeded by a narrow belt of *Chondrus crispus*, interspersed with *Rhodomenia palmata* and *Laminaria saccharina*, which is exposed only at low ebbs. The *Chondrus crispus*, however, extends some distance below low-water mark in to the laminarian zone, its fronds increasing in width as the water becomes deeper. The laminarian zone extends to a depth of from seven to fifteen fathoms. Here the great sea tangle, *Laminaria digitata*—improperly called kelp—abounds.

GATHERING AND CURING.

The mossers begin the "pull" of moss late on the spring tide of the full moon of May. This is earlier than it should be, for moss, like the grass in our pastures, attains but a feeble growth in the month of May. This prematurely-gathered moss suffers a great loss by shrinkage, and cannot be made to "hold its color" when bleached. This practice is probably owing to the restlessness of

those mossers who, having no gardens to plant, or but small ones, become weary of the idleness of winter, and are anxious to resume their customary labor.

Before any moss is pulled, however, the "bleaching beds" are carefully prepared. For these, sandy portions of the beach near the creeks are selected. The stones thrown upon the old beds by the action of the sea are raked off into something like windrows, which divide the plats. The contents of the shanties are overhauled. Hand-barrows, pulling-rakes, turning-rakes, and washing-tubs are put in order or replaced with new articles. The boats receive careful inspection. A coat of paint or an application of tar is, perhaps, the result. These boats are frequently loaded to the water's edge, and, when the supply of the more adjacent ledges is exhausted, often perform trips of several miles with such a freight. A leaky boat would be unpleasant—not to say dangerous. The "navigation" is, however, generally very safe, notwithstanding it is over ledges of rocks that are known to all mariners as extremely dangerous to shipping.

The Chondrus-bearing ledges are all within a few miles of the celebrated Minot Ledge light-house. Seven shipwrecks have been counted at one time on this shore, all in plain view. The light-tower rises ninety feet from a submerged rock, but at this writing the sea breaks against it so high that at times it is entirely hidden from sight! Yet in a few months scores of men will be moving about among these rocks, gathering a crop that hardly one in a thousand in the States knows anything about!

The tools of the moss gatherers are few and simple. The pulling-rake is the most important. It is a long-handled rake, with long, flat, iron teeth set closely together. The tub is a half hogshead; the turning-rake, a common hay-rake; while the boats vary considerably, but are good in a sea-way, especially when handled by experienced men.

The spring tides are selected for pulling, because the tide ebbs out lower than at common or neap tides. Spring tides occur at every new and full moon, when it is always high water a little before twelve o'clock; so the pulling comes at morning or evening, or both. The spring tides also expose a superior and cleaner variety of the plant, which is "hand-pulled" and carefully cured. Apothecaries buy this, and in the form of delicate blanc-mange it finds a welcome at the table and at the couch of the invalid.

The period of the spring tides is an exciting time with the mossers. The song of the boatman as he rows, the merry laugh and frolic of the boys, indicate that harvest time with them has come, and that before the husbandman has sown his corn! It is not intended to intimate, however, that moss-raking is as pleasant as raking red-top and clover. On the contrary, many tough farmer boys, after wading and pulling moss among the rocks on a cold morning in May, would doubtless abandon the business in disgust. A nervous man would hardly like it. There is a certain animal that roams among the rocks around, with such powerful pincers as to inspire a constant solicitude for the extremities, and woe to the luckless wight who comes in contact with them. Over a hundred thousand lobsters are taken annually by the fishermen of Scituate.

At the earliest dawn the boats are launched and rowed to the rocks, where the best quality may be found. If it is a very low ebb, the boat is forced as far among the rocks toward the shore as it will float, and the "hand-pulling" is vigorously commenced. The gatherers are not confined to the rocks immediately adjacent to the grounded boats. These exhausted, they wade to others and pick into baskets. Great care is constantly exercised to get good, clean moss, free from minute shells and tape-grass, for upon this the mosser reckons his price per pound. This pull also receives particular attention in bleaching and packing, and finally fetches two or three times as much as the common kinds.

As the tides in ebbing finally cease to expose the belt of rocks that produce the favorite variety, the marine farmer repairs with boat and rake to the outer chondrus-bearing rocks, whose abundant crops wave and surge with the swell.

Here the iron teeth do great service, coming up filled with a variety that contributes largely to the wants of the brewer and the cloth manufacturer. This moss is never so free from a living coating as the hand-pulled, and is mixed at first with tape-grass (*Vallisneria spiralis*) and other foreign substances. If he be an honest mosser you will, nevertheless, get a good article. Some men can scarcely fail to make good carrigeen of any gather, and they should be encouraged. Messrs. Howe & French, of Boston, are doing more in this direction than any other dealers.

The advancing tide or a laden boat compels a return to the shore. The boat is shot upon the beach, and the hand-barrows come into use. Two men soon carry away the load to the top of the beach, where it is spread on the bleaching-beds to dry. The remaining process any good housewife of the olden time well understands. Like the linen at the spring, it must be alternately wet and dried until the proper degree of whiteness is attained.

The washing is done in the tubs on the banks of the creeks which intersect the marshes and often approach the beach. Salt-water alone can be used, as the moss is very soluble in fresh. The tubs are quickly filled with a "long-handled" bucket, which must be an Irish invention, taking rank with the long-handled shovel. It is, albeit, a very expeditious method of filling half-a-dozen half hogsheads. In the "wash" the moss is well rinsed, and all floating pieces of tape-grass picked off. The water is then allowed to drain off, provided there be any unabsorbed, and the tub thrown on to its chine and dexterously rolled back to the beds. The spreading is repeated and, presently, the whole is turned with a rake, the curer, if he be a careful one, still picking out the poor pieces. The mosser gives a great deal of attention to the bleaching, which, in fine weather, is accomplished in about six washings. At low tide he still continues the pull with the boat and rake.

When the beds are covered with moss the heavens are as anxiously scanned as ever in hay time, and on the approach of rain a bustle is incident that is only equalled by that of the haymaker. The moss, if dry, is snugly cocked up like hay and covered with canvas. If the bad weather continues some time, it is as fatal to the carrigeen as to the hay, and is bound to turn out a damaged article, if circumstances are not the most favorable. If exposed to a long rain it rapidly dissolves.

At the spring tides the beds are generally covered with the freshly-gathered moss, looking black and uninviting; brt as the bleaching advances, the peats first appear to turn to a delicate red-color, and finally assume a yellowish whiteness that is very pleasing to the eye. When the carrigeen is properly cured it is stored in bulk in the shanties. As leisure comes, it begins to find its way into barrels. This is a time of temptation. A barrel of well-cured and honestly-packed moss should certainly never exceed a hundred pounds, and the average weight should be less than that. They frequently are made to weigh one hundred and twenty-five pounds. Specimens of our beach sand have doubtless been admired wherever Irish moss has found a consumer. Sometimes the moss *gathers dampness* at packing time, which is the more singular, as the weather is generally dry.

The careful mosser still picks over, and sorts as he picks, and his moss is now a white, clean, and salable article. A boy "treads in" as the final picking goes on. The nails that jingle in his pockets to the tune he whistles will hold the hoops and heads in their places. The barrel then awaits shipment, per packet, to Boston.

About the first of September the majority of the mossers close up their work on the beach, and fit out for the herring fishing. A few linger and cure another pull, if the weather favors.

As the number of men who make it their business to collect and cure this plant is increasing every year, the question is often asked, "Will it run out?" It is

not certain that the rocks, like some well-tilled soils, are increasing in depth and fertility, but it is certain that the moss grows of a better quality and quite as quickly the oftener it is pulled.

ITS USES.

There is always a demand for a prime article of Irish moss for culinary purposes, but the amount thus consumed is comparatively small, as a limited quantity of moss yields a large amount of jelly. In the form of blanc-mange, it is an agreeable and nutritious article of food.

In Ireland carrigeen is highly esteemed for its medical virtues, being regarded by some as a universal panacea. It was once a fashionable remedy in consumptive cases. As a demulcent for colds and fevers, it is very effective. Carrigeen has been much confounded with *Cetraria islandica*, (Iceland moss,) which contains starch along with a bitter principle, used as a tonic and demulcent. This opinion has extensively prevailed, and many still assert that the edible algæ of Ireland and the lichen of Iceland are identical.

Its most important use is as sizing, it being used in the manufacture of cloth, paper, and felt, and straw hats. The poorer qualities of moss are bought up for size. The hand-pulled moss, however, contains more starchy matter than the variety which is never exposed to the air. The second quality of moss is sold to the brewers. All beers when well brewed and sound, after a certain repose, become transparent or "bright," as it is sometimes termed. When, however, beer is sent out very new, it is necessary to "fine" it, or impart to it that "brilliant transparency," which is so agreeable to the eye. This is done by means of finings. In Europe isinglass is used for this purpose, and a lengthy formulæ is given for its preparation; but in this country Irish moss performs the same service without any preparation other than that given it by the curer. A certain amount of the moss is boiled up with the beer. The fluid gelatine unites with the tannin of the hops and forms a flocculent mass, which, enveloping the suspended feculencies, produces the clarifying action desired. The impurities are removed in the form of scum, while, with isinglass, they are carried to the bottom in the form of sediment. The beer is called "stubborn" by the brewers when a disengagement of carbonic acid gas occurs, the flocculent particles being thereby kept moving about without clearing the beer.

It is also used for fining coffee, and if it has no other recommendation, it is certainly cheaper than eggs.

Thus we have briefly glanced at some of the most useful algæ. Their production along the shores or in the deeps of the ocean, where no eye ever penetrates, is not in vain. The beautiful florideæ, whose crimson frond waves many a fathom down; the duller fuci, that float like pennants "where the tides and billows flow;" and the green and silky confervæ, all serve a purpose.

FEMALE LIFE IN THE OPEN AIR.

BY MRS. LAVINIA K. DAVIS, WARNER, NEW HAMPSHIRE.

We are all more or less familiar with the various criticisms launched upon us as a nation, by foreign, and especially by English travellers, and are amused or indignant, as the case may be, by the frequent want of fidelity and candor which marks such comments on American life and manners.

These "journalists" steam through a few of our principal cities, dine with a

few of our literary people, receive, as their just homage, the attentions and adulations of our hero-worshipping population, and go home fully convinced that they can show at once their gratitude and their superior powers of observation by an almost indiscriminate censure of everything they have seen, heard, or queried at, in their hasty tour.

With such specimens of modern *friendly* criticism before our eyes, we are led to form wonderful opinions of the courtesy and fairness of those very ancient times when the "patient man of Uz" wished that "his *adversary* had written a book" about him.

We all know how frightfully "new" we are; how "audacious," how "parvenu" we appear to eyes used to Old World notions and views, and we care very little for these grumblings. Youth is a thing that mends itself with years, and *we* shall, undoubtedly, be an "old nation" too, in the course of centuries.

What it *does* behoove us to note, however, (for there must, of course, be some grains of truth amid all this chaff of criticism,) is the oft-reiterated assertion of foreigners, sustained and confirmed, it must be admitted, also by our own travelled countrymen, *that there is in beauty, youthful appearance, health, and life itself, a most untimely and unaccountable decay among American women.* Nor can we, who come ourselves into the category of American women, *deny* the charge, however indignantly we may resent it. We have been too often pained by seeing girls, whose early youth was the personification of joyousness and radiant bloom, broken down with four or five years of housekeeping and motherhood cares—faded, pallid, spiritless creatures, whom necessity or conscientiousness alone supplies with vitality enough to carry them on for a few years longer, when they sink into early and too soon forgotten graves.

The contrast between English and American *young* ladies is, perhaps, generally admitted to be in favor of the latter.

It is doubtful if the world presents finer specimens of rounded, graceful, beautiful girlhood, from seventeen to twenty-two, than are to be found in most of our towns and villages; but from thence onward the universal verdict favors the English maiden. "Soon ripe soon gone," applies only too fully to our daughters, who attain maturity of loveliness at twenty-three, at furthest, (save the exceptions that help to make the rule,) while their English sisters, at that age, are just coming into a perfection of bloom that shall continue unimpaired for years.

What *can* be the cause of this premature decay? Is it our "climate," whose dryness, or other peculiar properties, makes us, of necessity, a "fast," excitable people, wearing out strength and brain, with a superabundance of nervous energy? Is it the "red-hot stove," burning up the healthful oxygen of the air, and leaving behind a deleterious compound, injurious alike to heart and lungs? Is it the "hot bread," eaten from Maine to Minnesota, indigestible as putty, full of headache and dyspepsia, sudden startings and restless sleep, that makes us thin, sallow, and sickly? Is it any of these suggested evils, or all combined, that make us what we are? or are these and other accredited ills aggravated and made deadly by our almost utter neglect of the out-of-door air and exercise which the Old World people know too well the worth of to despise as we do?

If the Frenchwoman has, unfortunately, a less agreeable abode, which *we* call "home," but for which she has no such name, she certainly gains a tolerable equivalent for it in the increased health, brilliant spirits, and sparkling vivacity, which only the outer air she dwells in can bestow.

Who has not been charmed by Sterne's description (in his "Supper and Grace") of the honest French peasant, who "gathered every evening, with the sound of his violin, on the esplanade before his cottage door, his children and grandchildren to dance and rejoice," believing, he said, that "a cheerful, contented mind was the best thanks to Heaven that an illiterate peasant could pay." The theology of the aged Frenchman may be questioned, the peculiar form of

amusement may be objected to, but the indisputable fact still remains that the simple-hearted old man had learned, from long years of observation and experience, that the innocent enjoyment of the outer world of nature was wonderfully conducive to health, cheerfulness, gratitude, and morality; and so far as these go, (and they constitute more of the real spirit of piety than we are apt to believe,) to religion itself.

The German ladies sit in their public gardens, or in the open doors of their own houses, for hours daily, knitting, chatting, or enjoying, in silent delight, the breath of the pure ether which surrounds them; while, in the rural districts the farm labors are carried on largely by the female portion of the community.

Though Americans are shocked by this reversal of their chivalric notions of the "sweet seclusion" due to woman, such work-a-field cannot be so very hard or distasteful to those of the softer sex who engage in it, since it is notorious that among the German emigrants who settle in our western States, and whose sturdy daughters would be such valuable "help" to our slender, overworked housewives there, scarcely any can be induced to enter service as domestics, they so much prefer keeping up the habits of the "faderland," and working out of doors.

The fact of this preference is corroborated by the following from Rev. A. B. Grosh, of the Department of Agriculture:

"I well remember hearing the women and girls among our native German farmers in Pennsylvania contend who should be permitted to go to work in the hay and grain fields in harvest time. Nearly every one preferred tedding hay, and raking and binding grain, to cooking or washing in-doors—preferred the heat of the sun in the open air to the heat of the fire in the kitchen or wash-house—preferred the lively companionship of the harvesters to the solitude of the house. In many cases the labors had to be divided, by a system of rotation, so as to satisfy each claimant for out-door freedom and health in turn. This was before the notion crept in that in-door labor was more 'genteel' for women than out-door work."

And so, in respect to living in the open air, is it in Spain, Italy, and most European countries. Who ever thinks of the senorita of the flashing eye and coquettish fan, except as she appears dancing with her young companions beneath the orange trees, to the tinkling of the shell-like castanets, or gliding along the public promenade, her charms of face and figure, less hidden than revealed, beneath the folds of the all-covering black mantilla? Or who dreams of Italy's dark-eyed daughters as shut up, even in the palaces they become so well, but rather as in the lovely gardens, among classic ruins, or sailing over the bright waters that enchain and beautify their land?

The Swiss of both sexes, living in mountainous regions and herding their flocks on perilous peaks, and breathing the clear air of those serene heights, learn to love intensely those airy homes, and are scarcely less agile of limb or sound of lung than their light-footed neighbors, the chamois of the rocks. The English, however, seem to have systematized the securing of this great boon of Heaven, the free use of the free air, more thoroughly and entirely than any other people. It is not with them as with dwellers in southern climes, the instinctive homage paid to cloudless skies and lovely landscapes—the *dolce far niente* that comes unconsciously to those who live "where the olive and citron are fairest of fruit." The humid atmosphere of the British isle, its oft-recurring clouds and storms, offer no such inducements to the idle rambler; and it is undoubtedly owing to the deliberate conviction that outer air and exercise are a necessary part of the training of girls, as well as of boys, and to the carrying out of this belief in practice, that the better classes of English (not the nobility, merely) are the most *thoroughbred* physically, if not mentally, of any people under the sun. Nor do they deem this desideratum a thing to be achieved in early years and laid aside forever after. It is not supposed *there* that being mistress of a house does away with the necessity for the invigorating breeze of

heaven, or that matronly cares and duties are, in themselves, so exhilarating and health-giving that the walks and rides and drives, essential to the young lady, can be given up with impunity when nerves and strength are additionally taxed in the new spheres to which marriage has called her. But is it not too common a thing in *our own* country for people to think that, though it may possibly be well enough for care-free girls to roam about the fields, or even to busy themselves somewhat in the manufacture of that anti-domestic, and, *therefore*, very doubtful commodity known as "street yarn," yet that same liberty must be rigidly denied to even younger females, whose inability to do likewise consists in the simple fact that they happen to have the prefix of "Mrs." attached to their names? The biblical injunction to "wives" to be "keepers at home," is made to signify far more in the estimation of grave judging mothers and aunts than the apostle ever intended.

We know, theoretically, as well as any other people, that the blood in the human body is sent to the lungs to discharge the poisonous carbon, and to take in a supply of oxygen from the air, which shall purify its unwholesome accumulations, heighten its color, and give it power to carry health and soundness to the entire system. We have all read, repeatedly, scientific computations as to the amount of carbon thrown off in a given time from a pair of well-regulated lungs, and the quantity of oxygen extracted from the pure air to supply their needs; and yet, to see how we act on such knowledge, let us compare our small ill-ventilated rooms, heated with close iron stoves, that afford no outlet to vitiated air, with the large, airy living and sleeping rooms of the English, where the unfailing open fireplace gives sufficient heat, and at the same time furnishes the most perfect possible ventilation. Let us compare our delicate, slender women, prematurely old and faded from being shut up in our unhealthy rooms, and seldom breathing the free air so necessary to health, with their portly, blooming contemporaries in the mother country, who spend hours of each day abroad, beneath the over-hanging sky, and carry its life and brightness to homes made happy by such communion with the outer world. We know, as well as they, that vegetable life, struggling in close, dark quarters, is blanched and sickly, without firmness or strength of fibre; and we ought to remember better than we do that the same causes brought to bear on the human frame will eventuate in equally ruinous results. The skin is pallid because the coloring matter, supplied by the sun and air, is wanting in the blood; the flesh is soft and flaccid because it lacks healthful exercise under wholesome conditions; and the muscles for want of proper use are little better than lymph, instead of being, as they should be, firm-knit and elastic, and capable of enduring the ordinary strains and trials of humanity.

It does not matter that Mr. Hawthorne, in his chivalric defence of his countrywomen, goes into a computation of the "beefy proportions" that go to make up the firm, compact masses of elderly English womanhood. The fact is still patent that their very constituents of body serve to keep the figure erect, the chest expanded, the lungs in healthful play, the cheeks and limbs rounded and smooth, and the features devoid of that pinched, nervous expression too often seen among ourselves.

It is not only the middle and poorer classes among Americans, in town and country alike, that suffer (from necessity, sometimes, perhaps) on account of their exclusion from healthful air and exercise, but often the very wealth that should give abundant leisure for seeking such wholesome adjuncts, becomes the unwitting excuse for their neglect, as well as for idleness and frivolous dissipation which increase the other ills.

And to show how this same, or rather how vastly *superior*, wealth operates on the English ladies, let us copy the following extract from "Rev. Henry Colman's Reports on European Life and Agriculture," written twenty years ago, and which were read with great interest by the scientific and agricultural world at large. He gives no name, of course, but we know he was received as a friend and an

equal by the noblest in the land; and his account leaves a wide margin for conjecture as to the wealth and rank of the fair subject of his story. He says: "I had no sooner entered the house, where my visit was expected, than I was met with an unaffected cordiality which at once made me at home. In the midst of gilded halls, and hosts of liveried servants, of dazzling lamps and glittering mirrors redoubling the highest triumphs of art and taste; in the midst of books, and statues, and pictures, and all the elegances and refinements of luxury; in the midst of titles and dignities and ranks allied to regal grandeur, there was one object which transcended and eclipsed them all, and showed how much the nobility of character surpassed the nobility of rank—the beauty of refined and simple manners, all the adornments of art, and the scintillations of the soul beaming from the eyes, the purest gems that ever glittered in a princely diadem. In person, in education and refinement, in quickness of perception, in facility and elegance of expression, in accomplishments and taste, in a frankness and gentleness of manners, tempered by a modesty which courted confidence and inspired respect, and in a high moral tone and sentiment, which, like a bright halo, seemed to encircle the whole person, I confess the fictions of poetry became substantial, and the *beau ideal* of my youthful imagination was realized. But who was the person I have described—a mere statue to adorn a gallery of sculpture; a bird of Paradise to be kept in a glass case; a mere doll, with painted cheeks, to be dressed and undressed with childish fondness; a mere human toy to languish over a romance, or to figure in a quadrille? Far otherwise: she was a woman in all the noble attributes which should dignify that name—a wife, a mother, a housekeeper, a farmer, a gardener, a dairy-woman, a kind neighbor, a benefactor to the poor, a Christian woman, 'full of good works and alms deeds which she did.' In the morning I met her first at prayers; for, to the honor of England, there is scarcely a family among the hundred whose hospitality I have shared where the duties of the day are not preceded by the services of family worship; and the master and the servant, the parent and the child, the teacher and the taught, the friend and the stranger, come together to recognize and strengthen the sense of their common equality in the presence of their common Father, and to acknowledge equal dependence upon his care and mercy. She was then kind enough to tell me, after her morning arrangements, she claimed me for the day. She first showed me her children, whom, like the Roman mother, she deemed her brightest jewels, and arranged their studies and occupations for the day. She then took me two or three miles, on foot, to visit a sick neighbor, and while performing this act of kindness left me to visit some of the cottages upon the estate, whose inmates I found loud in the praises of her kindness and benefactions. Our next excursion was to see some of the finest, largest, and most aged trees in the park, the size of which was truly magnificent; and I sympathized in the veneration which she expressed for them, which was like that with which one recalls the illustrious memory of a remote progenitor. Our next visit was to the green-houses and the gardens; and she explained to me the mode adopted there of managing the most delicate plants, and of cultivating in the most successful manner, the fruits of a warmer region. From the garden we proceeded to the cultivated fields, and she informed me of the system of husbandry pursued on the estate, the rotation of crops, the management and application of manures, the amount of seed sown, the ordinary yields, and the appropriation of the produce, with a perspicuous detail of the expenses and results."

After visiting various other places of interest to our countryman—the offices, stables, cattle stalls, poultry yard, dairy house, &c., &c., in regard to the management of which the lady showed equal intelligence; and after exhibiting the "Bailiff's Farm Journal and the whole systematic mode of keeping accounts and making returns," as well as her own "exact accounts of everything connected with the dairy, the market, the table, the drawing-room, and the servants' hall," Mr. Colman and his fair hostess separated, to be brought, as he says, "an hour after

into another relation; for the dinner bell summoned us, and this same lady was found presiding over a brilliant circle of the highest rank and fashion with an ease, elegance, wit, intelligence, and humor, with a kind attention to every one's wants, and an unaffected concern for every one's comfort, which would lead one to suppose that this was her only and her peculiar sphere. Now, I will not say how many mud puddles we had waded through, and how many dung heaps we had crossed, and what places we had explored, and how every farming topic was discussed; but I will say that she pursued her object without any of that fastidiousness and affected delicacy which pass with some persons for refinement, but which, in many cases, indicate a weak if not a corrupt mind." The remainder of the "sketch" must be omitted for want of space, but two or three "conclusions," arrived at by its author, ought not to be passed over. He speaks, first, of the gratification which any lady's intelligent interest in the business affairs of the outer and inner world of home must afford to her husband or father; secondly, that such cordial interest on the lady's part "divests the country of the *ennui* so often complained of as inseparable from it;" and thirdly, that "interest in, and familiarity with, even the most humble occupations of agricultural life, are not inconsistent with the highest refinements of taste, the most improved cultivation of the mind, and the most accomplished manners." It is to be deprecated, as a part of the actual loss which our injudicious seclusion from the outer world occasions, that we fail to perceive and enjoy as we ought the countless beauties which nature displays to her true worshipper. She reveals little to the cursory, indifferent glance; but to the loving, intelligent gaze, that notes her varied aspects, she is irresistibly charming. The world is full of poetry, and "eyes anointed read," so if we have hitherto walked blindfolded through a creation over which "the morning stars sang together," let us now wake to these blessed influences, and gather for our souls that perennial bloom that shall remain undimmed long after the tender grace of our youth shall have passed away forever.

It is no small favor, did we but so consider it, that, living in the free country, we have unchecked admission to sights and sounds that have given inspiration to genius in all past ages, and shall continue to charm the poet, painter, and singer through all coming time.

The brooklet gliding noisily over its rocky bed, bursting into aqueous gems where a tiny obstruction gives it excuse for flashing into a waterfall—or settling into shady pools to shelter the purple and gold-flecked trout—giving freshness to moss and lichens upon its banks, and brightness to flowers that nod in homage to its gentle ministrations; the mountain that rears its crest to heaven, and makes of its rugged breast a nursery for opal-hued clouds and lovely blendings of shapes and colors that vary with the changing hour; the stalwart woods that have flourished through the suns and storms of centuries; the quiet meadows, encasing in living emerald the river that rolls its resistless tide to the sea; all these and countless other rural scenes have given to such copyists as Claude Lorraine, Salvator Rosa, and Titian, imperishable renown.

Rosa Bonheur's celebrated "cattle pieces" have their prototype in every populous farm-yard, and on every hill-side where the lowing herd finds pasture, or the proud horse careers in unshackled freedom.

The very tones that charm our senses in the forest depths—where the breeze sighs through the reedy pines and the wood-robin pours his changeful song from his unseen thicket home; where the music of the stream, the drone of the bee, and the chirping of the insect tribes, fill the air with a harmony that scarce disturbs the wondrous quiet of the scene—gave to the master mind of Beethoven the key-notes of those sweet "pastoral symphonies" that flood the soul with exquisite delight, or startle it to ecstatic terror, as he reproduces the stern majesty of heaven speaking in the thunder and the tempest. How faithfully the full orchestra, rehearsing these wonderful compositions, repeats to us phenomena we know so well. We feel the supernatural hush that heralds the impending storm,

broken only by the low twitter of some frightened bird, or the murmurs of a summer zephyr dying in the distant tree tops. Then suddenly, from the rocky heights, shut out from view by the appalling clouds, bursts the loud voice of the winds and the fitful dash of the scattered rain-drops, outriders of the quick-coming storm. Low, distant mutterings fill the air, to be followed by the full force of the tempest. We hear the rattling musketry of hail; the intermitted roar of heaven's artillery rolls its deep thunder through the sky, to be echoed and reverberated, with scarce diminished power, among the far-off hills; while the lightning writes with fiery finger mysterious messages on the midnight blackness of the sky, and pours a momentary, unreal splendor on the strange obscurity of the scene. From these deliciously-painful, awe-struck heights, where we have witnessed the seeming "wreck of matter and crash of worlds," we are let down to behold the serener heavens and earth, filled with fresher beauty and sweeter sounds, and to feel that our own souls, as well as the great heart of nature, has been purified and elevated by this great elementary strife.

It were vain to attempt to speak of the poets—the priests and priestesses of nature—who have revealed to us her hidden mysteries. From the sweet Psalmist of Israel, down through all the ages, they have chanted hymns in her praise, and only a modicum of her charms has yet been sung. Beautiful as all these things are—and we would by no means disparage the works of genius—let us not forget that we have the originals of all these gems in art, literature, and music, daily before us, not shut in infrequent galleries, inaccessible to ordinary mortals, nor depending on trained orchestras at yearly exhibitions, nor locked in vast libraries to be read only by a favored few, but spread abroad, with lavish hand, by the Giver of all good things, and to be had, in one form or another, "without money and without price," by every country dweller under the sun. But if these attractions are insufficient to induce the increased occupation of the open air which this paper is designed to encourage, it is very easy to give tangible and profitable interest to out-of-door life by engaging in the culture of flowers and the smaller fruits, taking care of bees and other light pursuits, fitted to woman, that shall give to Yankee notions thrift, and to western ambition a "local habitation," while the actual benefit to health to be derived from the open air is equally sure to be secured. One can scarcely believe, who has not been led to look especially at this subject, how truly nature is her own best physician, and how surely, if sought in her native haunts, she administers not only to the "mind diseased," but also to the failing body. For one instance in point, let us refer to the article on "bee keeping" furnished to the Agricultural Department's Report for 1865, by Mrs. E. S. Tupper, of Iowa.

To say nothing of the interest that attaches itself to these insect colonies, whose half human instincts and delicious productions have made them objects of care and observation to all mankind; and without reference to the money she made by the business, which would astonish, by its amount, our eastern ill-paid female laborers, we will only quote the last paragraph, which gives the part of her story that illustrates our subject. She says: "I came west twelve years ago under sentence of speedy death from one of New England's best physicians, yet now rejoice in perfect health restored. More than to all other causes I attribute the change to the interesting occupation which has kept me so much of the time in the open air, *and paid me for being there.* I most heartily recommend it to those who are seeking either health or a pleasant, profitable employment." It was no mere "whim" which induced physicians in the "olden time" to order sickly children to be turned out of doors and encouraged to "play in the dirt," any more than it is a whim of doctors, in our present more enlightened day, to order invalids into the country or on foreign travel. Nothing is more truly wholesome than digging in the earth with spade or trowel, inhaling its free gases, suffering the sunlight to color and vivify the blood, the fresh air to strengthen and invigorate the whole system. The writer of this knew a lady who was threatened, in her younger

years, with a blindness, for which medical skill could offer no prevention or cure. She was told, as her only chance, to go into the country and try gardening; it would improve her health at least, and might, possibly, do what nothing else would, restore her failing sight. Her husband, a merchant in one of our large cities, sold out his large business, and retired to a pretty village, where a few acres gave her the opportunity sought. The cultivation of flowers, entered into as a remedial agent, became in time a passion with the fair devotee. To garden plots and green-house plants she soon added landscape gardening. A brook that wandered in native simplicity through the grounds was formed into mimic ponds, and tiny cascades laughed in the sunlight; arbors, groves, winding walks, and lovely vistas, and all the combinations of rural beauty which exquisite taste and abundant means could give to a spot of great natural advantages, sprung up beneath her direction, and much of the actual labor was accomplished by her own hands.

Fruits are the natural accompaniments of flowers, and before long she turned her attention to horticulture also. Berries and the larger fruits flourished, like everything else, under her skilful touch, and the grounds surrounding their elegant mansion were a perfect wilderness of sweets that administered delight to every sense. During the entire season in which out-of-door labors could be carried on she was at her post, arrayed in garden hat and gloves, from early morn till three o'clock in the afternoon. Help from stronger hands was always at her command when needed, but much of the actual labor of sowing, weeding, transplanting, training, pruning, and gathering of the produce was accomplished by herself. And yet she was no Amazon, let it be said to the delicate lady, who turns in disgust from this true picture of out-door life. Her years have numbered more than half a century, but you cannot find in any hall of fashion or indolence so youthful, so beautiful, so charming a woman. Her cheek has the genuine wild-rose bloom, and her soft, dark eyes show no symptom of the malady that once threatened them. Scarcely a silver thread mixes with the glossy brown hair that folds over a brow as smooth and delicate as a girl's. Her figure is erect and graceful, and her manners have the charm and freshness which the woods and waters and the thousand innocent delights of such a life as hers must bring to the appreciative soul. How many sick-rooms have been cheered, how many childish hearts made happy by her floral gifts, how many youthful minds have been moved to emulate such graces and virtues, who shall say? Let it be recorded that, in her place of residence, where many fine old families of worth and wealth give tone and zest to society, "the lady gardener of Elmwood" holds no second rank, while in homes of poverty and destitution no name is more tenderly or reverently uttered than hers.

Let no one say that this most rare example of American "female life in the open air" can have but few imitators, since to the great majority of them such *means* for indulging in rural pursuits must be wanting. The sequel of her story shows that such employments bring their own reward, in *money* as well as in health; for, though in the case above referred to no thought of profit entered into the lady's calculations, it soon became evident that, after supplying her family and friends with luxuries from her garden, a large surplus still remained. To prevent criminal waste, this was sent to market in the neighboring city, where her plants, fruits, and flowers now command the highest prices, and a large addition to their already liberal income is another pleasant result of her labors in the open air.

If to these advantages we take into the account the attractions which floriculture and horticulture give to country homes, and how much it would help to do away with the complaint that comes to us from every quarter, that young men and young women tire of the monotony and barrenness of rural life, and leave it for city employments upon the slightest pretext, we should see additional cause for urging upon women attention to these things. Many a mother has very

little idea how gratifying it is to the children of the household to have her interested in matters outside of the kitchen and the mending-basket.

A twilight walk, a stroll in the woods, a picnic, a berrying excursion, with "mother" for the presiding genius of the occasion, makes such a day one to be marked with a white stone, and remembered forever afterwards.

The writer of this, long since past her youth, has before her mind's eye, at this moment, a scene which occurred in her very earliest years—a simple rustic picture, but which stands out in far brighter colors than any worldly pageant she has ever seen since. It was a "strawberry festival," such as no "city hall" ever witnessed, but one in which her mother, her little sick sister, and herself participated. The plat of wild strawberries, not far from the house, had been discovered by the father's eye, and pointed out to us at dinner time. For the first and last time, the pale, helpless child, the careworn, yet smiling mother, and the hoydenish little girl went out together into the green fields and gathered the luscious fruit. Never was sunshine so bright as that which encircled with a halo of light the tender mother, as she filled with ripe berries the lap of the laughing infant, who clapped her hands and pulled buttercups and clover blossoms, with a sweet gaiety seldom seen on her pain-marked features. The little child soon left us, and the mother, long years afterwards, laid down the burden of life, and "went home" also; but she who is left alone of that happy trio looks back to that summer's day as one of the happiest of her life.

A bright boy of twelve came to spend a few months with a friend of his mother's. The lady he visited was a lover of nature, and, though it was early spring, and patches of snow were scattered over the fields and through the woods, it did not hinder the two from cheery walks in the virgin mornings over the drifts, or around them, on the dry crisp grass. They gathered red-cap moss and scarlet partridge berries, and carried home basketfuls of white pine cones, just to smell their spicy breath and see them burn at nightfall in the open stove, when every leaf of the brown unfolded bur turned into a point of brilliant flame, lit up the sitting-room with a waving, ruddy glare. The child enjoyed the lively chat of his elderly companion extremely, and one day, when they had had a particularly pleasant ramble, he threw himself down on a mossy rock, looked half admiringly and half regretfully at the blue above and the sombre brown beneath him, and said, with a pathetic emphasis that spoke volumes, "Oh, how I wish *my mother* would ever walk in the woods with me!" The boy's passionate cry was but the unspoken, often unconscious wish of every childish heart—the vague yearning for sympathy, for knowledge, for variety, for something more elevating and satisfactory than the mere mechanical routine of daily life that does not lift its gaze from the "muck rake to behold the crown." Happy is it for any child when he meets, in the maternal guardian of his youthful years, a loving and intelligent response to these appeals from his higher nature. If mothers and older sisters realized how much the after character of their sons and brothers depended on the home influences brought to bear on their youth, they would not feel that they had done all that belonged to them when they had presented them weekly with immaculate shirt collars, or spread unexceptional tables for their daily repasts. These are the "tithes of anise, mint, and cummin" which they ought to render, in tolerable form, perhaps, but for which they should not neglect the "weightier matters" of household love and mutual sympathy and consideration. The very restlessness which makes these incipient men sometimes troublesome, is but the native energy of character that, properly directed, shall make them pioneers in every noble undertaking. The inquisitiveness so irksome to thoughtless older minds is but the eagerness of the newly awakened love to penetrate into the mysteries by which it is everywhere surrounded; and guilty of no small crime is that mother who turns her child aside from her own teachings and companionship to seek the information he covets in vicious and ignorant, or, at best, doubtful associates. The broad, generous na-

ture of the boy that finds outlet and encouragement in a well-ordered and intelligent home, where his crude tastes are kindly directed, his wishes duly regarded, and his thirst for knowledge gratified, will very rarely prove recreant to such judicious training; while the same noble elements in another, thwarted and trampled upon, become the incentives to deeds of villany and crime. Far better would it be for mothers to throw aside some of the needless adornments of dress, and the exquisite niceties of housekeeping, or even to cater somewhat less fully to the masculine appetite, (quite likely enough to become epicurean without any early pampering,) and, with the time thus gained, meet the boys on their own ground. All the better for both parties is it if it happens to be the croquet, the nutting, the hunting, or the fishing ground. If she has been properly taught herself, the mother can make any of these the school of good manners, of natural history, and general information. Botany and mineralogy are "at home" in the woods and fields; but if we do not know the sciences technically, or do not care to take them from the schools to which they have been transplanted, there are a thousand things to be learned by observation merely, which shall profitably occupy the youthful mind, to whose insatiable curiosity nothing comes amiss.

How many ladies of professed and real intelligence have any idea of the variety and beauty of the wild wood and field flowers that bloom, almost unnoticed, from April till November? or of the different kinds of forest trees—the peculiar texture and color of the bark and shape of leaf belonging to each; and the different classes under the same name, as, for instance, the numerous family of maples and the tribe of birches? How many know the various haunts of birds peculiar to their region? the distinctive plumage of each species, their time of migration and return, the note belonging to each, and the manner of building their nests? How many mark intelligently the varying mosses that carpet the rocks, or cushion with rare velvet the trunk of the fallen tree? How many see, with appreciative eye, the countless shades of green that crown the spring with beauty, or note the changing hues of the mountains and clouds, and the wonderful effect of light and shade on landscapes? How many ever sat, like Thoreau, "so still among the solitudes that the shy creatures of the woods supposed them stumps," and went on with their work or their play, with charming frankness and simplicity? And yet a practical knowledge of all these things can be gained, along with the children, in those excursions in the open air which every woman's health and spirits require her to take daily. Nothing has been said directly as to the ill effect on the nerves, and, through them, on the spirits and temper, which a want of wholesome air brings to care-worn females; but the single speech of a lively neighbor of mine, last summer, sets this part of the subject in its true light at once. I had not seen her out for a week, and supposed her either sick or away from home, when she drove up to my gate one morning, with all her children, in the carriage, and stopped to exchange salutations. She really looked less bright and blooming than usual, and I said, "You have been ill." "There it is again," exclaimed she, laughing; "everybody sees the want of oxygen in my blood. The truth is, I have been sewing steadily for a week upon the children's dresses, and have not allowed myself a breath of the fresh air which I have always deemed quite essential to my health, and on which I am now convinced that my *good nature* depends entirely. At the end of three days of unbroken sedentary employment I begin always to falter, and can hardly eat or sleep; but on this occasion I held on to my work, and finished article after article, till my head was in such a whirl I could hardly count the garments as I laid them away. But yesterday I became desperate; I scolded poor Bridget, for some slight mistake, till she looked at me in unutterable amazement; I ordered every child out of the house, even baby Benny here, because I could not bear the sound of a footfall within it; and when my husband came home at night, and told me I looked really ill and nervous, 'it was the last feather that broke the camel's back'—I was sure it was only a courteous way of saying I

looked cross and ugly, and I burst into a fit of inconsolable sobbing, and went to bed, like a naughty child, at eight o'clock. This morning I locked up the unfinished pile of sewing. We have the dinner basket back there in the carriage, and are off for the woods. The children say they are in pursuit of fun, but *I* am after oxygen."

A word as to the spiritual influence of agriculture, and this too protracted paper shall be closed. If it be true that "the undevout astronomer is mad," what shall be said of the husbandman who, receiving his daily bread from the very hand of God, with the intervention of scarcely any secondary causes, is yet so stupid and hard of heart as to refuse gratefully to acknowledge his power and beneficence? In its primary sense of tilling the earth for the necessary food of man, or in its broader meaning as including horticulture, floriculture, &c., it differs from every other occupation on earth. As it was the sole employment of our first parents in their state of innocence, when God came down and talked familiarly with them as man with man, so now the culture of the soil brings us into closer communion with the Author of all good than any other occupation can possibly do. Mechanics and artisans of all degrees work on materials already furnished to their hand, and elaborate their designs with actual, tangible stock, dug from the earth, collected from field and forest, brought up from the mighty deep, or drawn, like electricity, from the sky. The farmer or gardener, on the contrary, holds in his hand a tiny seed, a thing, apparently, of utter insignificance; and he seemingly values it so lightly that he casts it into the blackened earth at his feet. But now behold a mystery! This man so doing is working hand to hand with God, doing his small part in the ever new work of vegetable creation. The almost invisible speck of matter, so seemingly lost in earth, is only the slender germ dropped from the reverent hand of man into the fruitful palm of God; and from this life-giving death it comes forth a "lily of the valley arrayed as was never Solomon in all his glory," or a vine that "shall make glad the heart of man," or a cedar that shall be the glory of Lebanon. Not planned and put together by the "cunning device of men's hands," as they build a temple—tier after tier of brick or stone—but wrought from invisible, intangible gases and elements gathered from the earth, air, and water—diminishing by no iota the original constituents from whence they sprang—spreading into forms of inimitable beauty, and standing, like the new earth, a miraculous creation, and worthy to be pronounced "very good." Who shall contemn such glorious labor as this? Who shall not rather rejoice to fulfil his allotted sphere in such copartnership, and deem it honor enough to be a co-worker with the Eternal?

WOMEN IN PARIS.—That the readers of the above essay may note the difference between this and foreign countries, however enlightened, in the courtesy shown to women, and see the drudgery to which the majority are doomed, the following quotation from "Carleton" (Mr. Coffin) is made. He is describing the great market of St. Eustach: "It is an immense structure—a great iron shed or sheds, covering two squares; women at all the stalls—burley, red-faced, wielding cleavers, cutting up sides of beef; fish-women, crying in shrill voice the excellence of their sole and salmon; fruit-women; sellers of vegetables, and pretty girls with flowers for sale, beseeching you with such grace that you are the owner of a boquet before you know it. There goes a woman with a basket of potatoes upon her head; another with a big tub filled with meat. There comes one with a sack on her back filled with baskets; another trips along with a yoke on her neck bearing two pails of buttermilk. She is certainly under the yoke, and so are they all. No respect is paid to public places. Gentlemen puff away at their cigars without deference to the presence of a lady, no matter how well dressed or how well behaved. No Frenchman resigns his seat to a woman. He may bow very low and do anything for Lady So-and-so, but for a woman he may meet in public, never!"

EDUCATION OF FARMERS' DAUGHTERS.

BY MISS L. C. DODGE, NASHUA, NEW HAMPSHIRE.

It is quite too late to question the propriety or the necessity of female education. Under a government founded upon universal intelligence, few could claim for the daughters of the people a less varied training than for the sons, however it might differ in particulars to suit the duties and destinies of the two sexes. Our countrymen are disposed to do full justice to the girls in their distribution of educational facilities; indeed, in the older States and in the most cultivated districts the daughters are permitted to enjoy school opportunities to which their brothers are strangers. It is at once admitted that the importance of female education is generally appreciated. The question now is, Is it all it should be, and can it be improved?

To ask such a question is to answer it. With the evidence of progress in mental culture in every phase of human society and in every corner of the world of civilization, we may be assured that the daughters of free America will not remain in blissful satisfaction with the attainments of the present.

Education in Europe is becoming more popularized and practical, and the improvement is liberating and equalizing the slaves of caste and ignorance, and its ameliorating influence is felt upon despotic governments and their haughty rulers.

If it could seriously be said in England, in the days of Sidney Smith, that "it is not easy to imagine that there can be any just cause why a woman of forty should be more ignorant than a boy of twelve years of age," such an insinuation would now certainly excite the derisive smiles of English women and the indignation even of the most self-satisfied cockney.

It is said, too, and shown from public records of France, that the last half century has wrought a wonderful improvement in the average educational condition of that country. At a low ebb among the working masses fifty years ago, and still far from the elevation it should attain, female education in France has wonderfully advanced and is still progressive.

Thirty-five years ago, in the primary schools of that empire, there were ten boys to every six girls. Since that period the number of children attending school has doubled, and the proportion of girls has increased from six-tenths to seven-tenths, as compared with the attendance of boys. Then forty-five per cent. of males from five to twelve years of age were not in any schools; now but twenty-one per cent. of the same class are absent. In 1836 sixty per cent. of girls between seven and thirteen years were not under any school instruction; in 1857 the percentage was reduced to twenty-three.

In other countries similar progress has been developed; and everywhere, as the general improvement keeps its equal pace, female education and disenthrallment advance with far more rapid strides.

NATIONAL IDEAS IN EDUCATION.

But in this republic is found the highest development of popular education, of both sexes and all stations in life and grades of wealth, and in its distribution it is more nearly equal than are individuals in social rank and other artificial distinctions. This superiority is due to the fact that it is distinctively American, in accordance with the republican idea and a part of its development; and as our

government is perfected, and freedom and equality are universally assured, education will have a wider and higher range, and female culture will continue to take a prominent and influential part in the triumphs of educational progress.

The cardinal principle of our government being equality in the exercise of natural rights, education must become more nearly universal than in any existing foreign government. Neither sex nor race, color nor class, is regarded in conferring opportunities for culture, though constant discrimination should be made, and special means employed, to fit each individual for the sphere or the vocation in life to be filled. The world seems to be just beginning to learn practically that minds are not fashioned from the same pattern, like the latest modes from Paris, and that education should be general and uniform for all, so far as it may be necessary for social harmony and a proper mental balance, and specific to suit the peculiar wants of the individual. This twofold character is now more realized than ever before, and in this country, as it is and as it can be in no other; and while the foundation of present culture is becoming broader, and its superstructure higher and more substantial, its adaptation to anticipated uses and employments is more marked, and its outward style and finish more in keeping with its peculiar location and surroundings.

As this country is continental in extent, no "pent-up Utica" should contract the range of its scholars—embracing all climates, its intellect should combine a semi-tropical warmth and coloring with the vigor and enduring strength of the temperate zone—with broad plains spanned with railways and coursed with flowing streams, mind should be free, active, and swift—comprising mountain ranges with heaven-piercing peaks, thought should be trained towards the illimitable and sent forth in search of the infinite—including all races and tongues, the lore and languages of the world should blend their treasures to enrich its literature.

Whatever characteristics it may possess, the great fact in connection with this "land of the free" is the intensely practical character of its people. A new continent is opened to civilization, and its former tawny occupants, henceforth out of place upon the busy scene, shrink away and die. The stream of humanity flows westward, from ocean to ocean, rolling over mountains without regard to the laws of gravitation; grappling with nature at every point, intent upon utility first that beauty may come afterwards. Riches are coined from the prairie earth and the gentle rain, the forest mould and the golden sunshine, the lowly plant and the mighty tree, the mountain rock, the river sands, the bosom of the lakes, the waves of ocean—all by the aid of human muscles and the sweat of the face of man; and from rosy morning till the last faint thread of twilight disappears, the day is filled with sounds of labor and sights of industry, as the products of field, wood, and mine are fashioned and fitted for the aliment, comfort, or convenience of man, and made to swell the aggregate of material wealth.

In such a country the education of the cloister will never answer a practical purpose. Delving in classic mines through weary years, till the atmosphere of the present is mouldy with the emanations of the dead past, will not suffice for the activities and practicalities of this living age. The theory and philosophy of language must take a high place in American education; but science, in its myriad applications to art and invention, opens a field inviting, alluring, and boundless, which promises more of good and glory than any other path of learning. It is yet a new path. Alas! how little do the "masters" of special branches of science at present know of the treasures of which they have caught but glimpses, and how powerless are they to apply this knowledge to human arts or the wants of man. Mathematics must be relied on as a balance-wheel to give stability to the mind in this era of impulse and will; and to none can it be more useful than to the women of our land. It is an error long since dissipated that girls cannot understand or appreciate the higher mathematics. I have known classes of girls, year after year, to equal or excel the attainments of similar college classes of boys in the same neighborhood.

I will not extend this branch of the subject. In a word, our education must be suited to the peculiar character and wants of the country in which we live; it must be broad, progressive, practical, and in accord with the highest humanity. These hints point to views already crystallizing into a system of American education in the minds of the practical scholars of the country.

A RURAL IDEAL.

In the formation of a national education, as of a national character, the country more than the city must control. The city becomes cosmopolitan; its people, blending all nationalities, lose distinctive national characteristics, and I have sometimes thought, judging from popular manifestations, love of country as well. Ignorance concentrates, and while the favored few enjoy superior facilities and attain scholarly reputation surpassing most people in the country, they are but the few, and a proportion which can never exist in the country are doomed to ignorance unillumined by any sign of amelioration. There are sections of every city which are nurseries of barbarism. These sections increase with the growth of the cities, and, I fear, also in proportion to population as time advances.

The superintendent of schools for the city of New York, reporting the number of children taught in those schools as two hundred and twenty-two thousand, places the average attendance at less than ninety-two thousand. Nearly two-thirds of those nominally in attendance are absent from the schools. In Philadelphia, that beautiful city of cleanliness and thrift, twenty thousand children neither attend school nor engage in any useful employment. In Chicago are forty-five thousand children of the age for school instruction, but scarcely twenty-five thousand are enrolled in the public schools. Some attend private schools, but thousands are growing up in ignorance. Of those whose names are on the list, there are so many habitually absent that fourteen thousand seats are ample for their accommodation. It is said, further, that of those present on any given day not more than a third occupy their seats more than nine weeks in the year, and scarcely more than a fifth of the remainder are regular in attendance.

In every city the same results are seen. Upon the country, then, must we rely for the perpetuity and success of the great American school system. Not only from the superior character and more earnest patriotism of the toiling masses of the country, but from their greater numbers, in hillside and in valley, throughout the length and breadth of a great continent, can we assume their controlling influence in national education.

It can now be seen why so much prominence is given to the rural population in our dreams of educational progress. It comprises a larger and more hopeful element of improvement than the city—an element that has more of truth and nature, more of virtue and principle. In the country will the defects of the present system be most readily remedied, and there will reforms be inaugurated most hopefully. In these facts, and in the superior efficacy and elevating tendency of female influence in rural life, are found the reasons why I treat specifically of the education of farmers' daughters. It is not that they require a totally different education from that of other girls, but that they can be more readily moulded to the ideal of a superior and more practical culture, and can then stamp more effectually their impress upon the society in which they move.

Farmers' daughters constitute an important part of the rural population to be educated, as doting fathers, fond brothers, and others possibly still fonder, will readily admit; their initiation in any path of educational progress would be the signal for the boys to follow. There are also special defects to be remedied in the general education of girls, which are either peculiar to female education, or are not found to exist in the same degree in that of boys.

Let the girls of rural America reverently bless God for their birthright in a free realm, where the daughters of the farm are not the children of peasants, and can never become the slaves of serfs—where an actual log-cabin may be ex-

changed for the presidential mansion, or, better still, the home of intellectual eminence or moral pre-eminence. Among the nations, as man is dwarfed and restrained by imperial edicts, social customs, or ancient superstitions, in an increasing ratio is woman enslaved and belittled in soul and intellect. There is, indeed, a long stride in progress from a Turkish toy with a soul in it, for which there is no acknowledged use, to a French exponent of fashionable and artistic elegance; and a further progression to an English embodiment of home virtues, intelligence, and sturdy sense. Yet the best of the women of England are separated by cordons of caste and barriers of foolish pride, which prevent the development of but a single side or two of human nature, and cramp the free play of the highest sympathies and sensibilities of the human soul. In this country, not only is there opportunity for development, entirely unrestrained, and which nowhere else exists, but there is the spur of every imaginable motive for it. The prejudices of the past are here melting before woman's pathway; the barbarism of legal disabilities is disappearing; the injustice of offering unequal rewards for the same measure of effort is admitted; and the heavens, which frowned upon our way, are clearing for a day henceforth bright and glorious.

Are the young women of America alive to their opportunities, and able to realize their full capabilities, while filling more perfectly than could otherwise be possible, the holy offices of daughter, sister, wife, and mother, thus giving to the world the highest type of feminine excellence? To the girls of the land we must look for the realization of such a possibility. And who will appear as the leading element in the improvement? Not certainly those of the principal cities. Too much of the hollowness of conventionalism, too much of the selfishness of mammon, too much of the frippery of fashion, and too little of the freshness of nature exist there to admit of such a hope. There is highest culture, wisest discipline, and noblest development occasionally found in cities; but it is folly to expect the mass to be leavened by it amid so many adverse influences.

Then to you, girls of the farm, companions of the birds and the flowers, do we look for education that shall combine a broader mental training, a truer moral culture, a better physical development, and more sensible and practical views of your share in life's duties. Many await the realization of such an ideal, in the full belief that it is not only possible, but near. As the men of this country are more active, enterprising, and effective in accomplishment than those of any other, why should not the women be more intelligent, companionable, and healthful than those of any country in the civilized world? It is a glorious aim, and country girls will be foremost and successful in the effort. Then may universal fame accord to American women the praise which M. de Tocqueville has already given them, in saying, "I have nowhere seen women occupying a loftier position; and if I were asked, now I am drawing to the close of this work, in which I have spoken of so many things done by the Americans, to what the singular prosperity and growing strength of that people ought to be attributed, I should reply, *to the superiority of her women.*" If this superiority is indeed so manifest, and is to be permanent and progressive in its best features, it will be due to the fulfilment of the four requisites of woman, in the Chinese maxim, "That virtue dwell in her heart; that modesty play on her brow; that sweetness flow from her lips; that industry occupy her hand." Such characteristics, superadded to intellectual superiority, will result from the judicious training of all the powers and faculties of woman's being, in the realization of our ideal of what female education should be in the United States; and in the future may be produced many a woman as deserving of high encomium as the wife of John Adams, of whom he wrote: "There have been few ladies of the world of a more correct or elegant taste. A collection of her letters, for the forty-five years that we have been wed, would be worth ten times more than Madame de Sévigné's, though not so perfectly measured in syllables and letters, and would, or at least ought to, put to the blush Mary Wortley Montague and all her admirers."

MENTAL TRAINING.

Female education should not be partial or one-sided, but should include equally its mental, moral, physical, and domestic aspects. The idea is not new to teachers of girls; its force is readily acknowledged; yet it needs to be more deeply impressed upon the popular mind as a vital practical fact. Day by day are educational facilities sought with greater assiduity, and improved more fully and practically; still it is painfully evident that it is lacking in depth and completeness. Books, teachers, time, and means are often employed, and the woman is but half educated—rather there is educated but half a woman. Education should be for life; much that goes by that name is for youth and early womanhood, and is but little adapted to the later years of life, and that little has been so subordinate that it is forgotten, or only feebly remembered. Mental training should be intended for utility more than show, for enduring permanency more than temporary brilliancy, and for matronly activities rather than matrimonial success. It really seems to be the idea of some that the *end* of education is marriage, and to them marriage is its termination, as well as its aim. It is thus debased to serve as a bait with which to catch husbands, when no such enticement is necessary. The freshness and vivacity of youth and beauty suffice for such angling. When they have faded and fled, and cares and sober realities follow, more enduring charms of mind and spirit, skill and tact are needed to retain and deepen the affection so naturally inspired. An eminent writer, in another country, fifty years ago expressed concisely the want of to-day—an education that will give "resources that will endure as long as life endures; habits that time will ameliorate, not destroy; occupations that will render sickness tolerable, solitude pleasant, age venerable, life more dignified and useful, and therefore death less terrible."

We need in the mental training of girls (which is the branch of the subject I shall first consider) more attention to the development of the reasoning faculties, by means of mathematics; more acquaintance with the forces of nature, by the study of natural science; a better knowledge of the philosophy of language, and the graces of diction; and by no means least nor last, more complete mastery of the minor but essential primary branches of education, which are so apt to be neglected for more pretentious studies.

No one need fear, in a culture so symmetrical, the possible reputation of a "blue stocking;" that term has lost its power to frighten even the timid, and is growing obsolete, since it can no longer be used as an excuse or cover for one's own ignorance. Nor will pedantry, that evidence that "a little learning is a dangerous thing," ever result from such a culture, though it may for the want of it.

There are evils in female education which farmers' daughters, in the simplicity and vigor of their unvitiated natures, will easily learn to avoid. Of these I will briefly illustrate a few of the most conspicuous, and point at a few reforms.

A servile imitation.—One of the worst mischiefs of our system of female education is its too prevalent imitativeness. Custom has often the force of law, and the curriculum of a female academy is as inflexible as fate when it should be as elastic as youth. Studies allowed to one are compulsive upon all. Fond mothers require attention, *seriatim*, to every separate item on the intellectual bill of fare, whether their reluctant daughters have an appetite for each or not. Every adjunct of study known to the institution must be furnished. The traditional wish that a lacking "capacity" may be supplied is not an exaggeration. Colleges for males are rapidly changing their cast-iron usages in this respect. "Scientific courses" of study, separate yet similar, each making one science prominent while blending others allied to it and to the central idea of the course, and all preceded by a uniform general training, are instituted by the best colleges, and are yearly advancing in popularity and patronage. Already has one prominent female

iool in New York city adopted the idea, so far at least as to permit a selection studies from the list suited to individual tastes and capacities and expectations life. Of course the student should not apportion her work at will, nor should teacher arrange her course at random, or without careful study of the case and exercise of rare judgment in the decision. Let this plan be generally pur- ed in female schools, and the wealth of these golden opportunities would not lavished on unappreciated or unattainable objects. There are some natures— re than would at first appear—that will break rather than bend to a prescribed t uncongenial course of study; and there are many, among girls as well as boys, king melancholy failures in some forced pursuit, who would shed the light of l genius upon some other path of culture if permitted to tread it. Instances not rare in which a sort of martyrdom has been suffered, with no useful result, fore the bonds of an iron custom have been broken and the mind is left free its eager flight.

Routine.—There are red-tapists in schools as well as in official circles, teaching re of form than of substance, repressing rather than expanding, and expecting pils to digest the shell rather than the kernel—an effort resulting in starvation intellectual dyspepsia. With them *to educate* means to restrain, to lop off, or most to cram, and not to draw forth, expand, and strengthen the mental powers. attempt is made to educate by machinery, which operates with merciless iformity upon all material, and finishes off all in the same style and pattern, dy to be turned out of the mill, properly labelled and thrown upon the market. e teacher is a man of text-books; a recitation a matter of memory; instruc- n a daily drill, and examination a dress parade. Facts, formulas, and rules taught instead of principles, and children intended for men and women of elligence are made learned parrots. School drill should not be a ligature, ecking mental life in its course, but a leash, permitting voluntary action while hering firmly to a principle. This drill is stiff and chilling enough in colleges males, but it is often worse in female seminaries, extending to study, manners, l physical exercise. Discipline is necessary and firmness essential, but this t of training should not be the beginning and ending, body and spirit, of the ication of girls. Country maidens, accustomed to freedom of movement and stirring scenes of animated nature, do not relish such restraint, and will not rays endure it. They, at least, if no others, can appreciate a more wholesome imen. For them I plead the furnishing of opportunities for a free, true, and eral culture, in which the real uses of knowledge may be taught, and the true poses of life unfolded. The girls of rural America will not be slow to profit the teaching of such schools.

Want of thoroughness.—Another want in female education is thoroughness. r girls often lack earnest, determined, concentrated effort in study. The ten- icy of fashionable life is too much towards encouraging in girls a listless, aim- s habit, frivolous occupations, and superficial attainments. A boy is thrown n his resources while despondingly unconscious of possessing any, and left battle desperately with the world, when he arouses himself as a young lion, iggles mightily with opposing obstacles, and ultimately accomplishes results which the world wonders scarcely less than himself. The rough experiences ich guide a poor boy through college to an honorable success in science, busi- ss, or statesmanship may not be desirable stimulants to effort in the case of sisters; yet many a one has been left to the bitterness of such a trial, and won trophies and rewards which prove her equal to her brothers, and show it the difference between the sexes in this repect is more the result of circum- nces than of difference of mental organization or strength of will. None can more patient, unremitting, and self-sacrificing than young women of a tender and rearing have sometimes been in acquiring a culture suited to insure in- endence, the support of an aged mother, or the education of younger brothers sisters. Something of this thoughtful earnestness should characterize the

young women of the land in this age of co-operation and effort; arouse a higher ambition, and fire a loftier purpose. Men are impelled to action in this country by forces that they cannot resist; women, in their own sphere, must share the impulse and move forward with equal pace in the same direction, obtaining a like breadth of views and depth of practical culture. Emphatically true here is the saying of John Stuart Mill in the English House of Commons concerning his own countrywomen: "The time is come when if women are not raised to the level of men, men will be pulled down to theirs." Who, if not farmers' daughters, will respond to these suggestions, and infuse into their school life a zeal for thorough culture and genuine attainments that shall brighten as they bless and beautify a happy and useful life?

Accomplishments.—The lighter accomplishments which serve to cheer the intervals of relaxation from life's labors of love and duty are necessary and commendable. While they should be subordinate, I would not characterize them in the somewhat too harsh language of the Edinburgh reviewer: "No mother, no woman, who has passed over the few first years of life, sings, or dances, or draws, or plays upon musical instruments. These are merely means for displaying the grace and vivacity of youth, which every woman gives up as she gives up the dress and manners of eighteen; she has no wish to retain them, or if she has, she is driven out of them by diameter and derision." Superficial attainments, whether illustrating the grace or the grandeur of mental culture, are evanescent, and many a school-girl's acquirements are indelible as characters written in the sand of a wave-washed shore; yet many American girls, as they increase in years, excite envy rather than derision by the display of mental and social diameter attained by the lively exercise of powers brought into conscious being and trained to activity in school life.

If a country girl can only enjoy a few months' tuition, beyond the most primitive local opportunities, it is folly for her to spend those precious hours in servile imitation of the boarding-school miss of ample time and means, for the sake of murdering a few airs from operas and acquiring certain airs of affectation, or of mispronouncing and misunderstanding easy French without the ability to use with accuracy the mother tongue. If these accomplishments can, indeed, be made an aid to elegance, rather than a cloak for vulgarity and a stimulus to pretence, they may be useful concomitants of education, like a simple dessert after solid meats; but whipped syllabub would not be a suitable diet for a dairy maid, or an economical one for her who may be liable to the risk of a scanty meal. Affectations and shams may be expected in the city, but the education of the country girl should be in accord with nature, suited to her circumstances, tending to fit her for every duty that may devolve upon her, and enabling her to seize every opportunity of social advancement and beneficent action. It should be true, sensible, practical, and earnest.

Home training.—I desire to urge seriously upon mothers the importance of keeping their daughters under their own roof-tree instead of sending them prematurely to boarding-schools before habits of study and thought are formed, and moral principles firmly fixed; otherwise the probability is strong that they will return totally changed in tastes and feelings, with false views of life, disgust for old associations, and, perhaps, old associates, and superficial attainments. A gentle, sympathizing daughter is lost to the hearthstone, and a self-willed, vain, showy, but shallow young lady has taken her place, who is more anxious for a settlement in life than for the ability to sustain herself with honor and grace in her chosen sphere.

The older States are full of local schools, which, with the home-training and an intelligent mother's guidance and instruction, can furnish means for laying a solid foundation of a female culture that no boarding-school, however home-like, may equal. The age at which the aid of boarding-schools may safely be called in requisition, when circumstances forbid the completion of education at home,

will depend somewhat on the temperament, degree of moral and mental maturity, and character and length of previous training. A judicious mother will be a safe judge, if not too timid to dismiss her fears of the safety and success of her well-trained and sensible daughter in her experience of boarding-school life.

Boarding-schools should aim to retain rather than destroy the charm of freshness and simplicity that characterizes home life, and to develop a symmetrical and complete culture instead of a baneful brilliancy that may not be permanent, and will not insure happiness or usefulness. Correct ideas on this point are gaining prevalence, and schools can be found promising an approach to such realization. If farmers' girls must be sent from home, such schools should be selected for their education.

MORAL CULTURE.

Perhaps no proposition is more evidently true than that all intelligent beings are under obligations to obey the will of their Creator. Since they can possess no power or faculty independent of Him, they can have no right to exercise their faculties independent of His will. Obedience to our Creator's requirements is our duty, because they are His requirements; while it is our interest, because they are so designed by an all-wise and infinitely good being. All actions in accordance with His will are right and beneficial, and those opposed to it are wrong and hurtful. It is therefore manifestly a most important part of a complete education to train the conscience to a just discrimination of what is right and what is wrong in human conduct, and to discipline the will to choose the right, not because such choice will result to the advantage of the actor, but because the action itself is right.

If "an undevout astronomer is mad," how anomalous should be a lack of conscience or innocence amid the purity and freshness of nature. The country girl moves and breathes amid a constant succession of miracles of germinating grain, springing blades of grass, and the wonderful transformations of insect life. Did we not know that the serpent had once been in Eden, it would scarcely seem necessary to encourage moral culture on the farm, where virtue might be expected to flourish spontaneously. Experience of human nature teaches that constant vigilance in moral culture is indispensable, and observation points to rural scenes as the natural temples for the successful inculcation of such teachings.

It is a branch of education upon which the value of all other culture depends. It elevates and sanctifies all other acquisitions. Without pure morals, a community, however trained in intellect, would lose all mental aspirations, and ultimately retrograde into barbarism. It is claimed that a republican form of government cannot exist without general mental culture; but a lack of moral training is far more dangerous to free institutions. This was the belief of the fathers of this republic, and to their teaching we owe much of its progress in greatness. "It is impossible to govern the universe without God," said Washington, and "*a fortiori*, impossible to govern a nation without Him;" and the second President said specifically of the moral influence of our sex: "The manners of women are the surest criterion by which to determine whether a republican government is practicable in a nation or not. The Jews, the Greeks, the Romans, the Dutch, all lost their public spirit, their republican principles and habits, and their republican forms of government, when they lost the modesty and domestic virtues of their women."

Those who have the care of the children of a nation, in the first few years of existence, will stamp upon them and the future government their own impress. Public men attaining success in statesmanship almost invariably refer to the moral influence of mothers. Scores of notable examples in the last generation could be quoted; and the present age will furnish as many. That eloquent southern advocate of freedom and republicanism, so early gone to his rest, Henry Winter

Davis, said of his mother: "She was the incarnation of all that is Christian in life and hope, in charity and thought, ready for every good work, herself the example of all she taught."

Important as attention to morals may be generally regarded, it is in great danger of being ignored in the school, crowded out of sight by numerous and multiplying expedients for undue stimulation of the intellect. There are set times for mental but not for moral exercises. Text books and routine fence in the hours devoted to the culture of the mind; perhaps a brief scripture reading and prayer attend the daily opening, but oftentimes that is all of morality involved in the diurnal session.

What is wanted is a constant watchfulness over the temper and deportment of each member of the school; the calling forth and strengthening of the affections, as in the daily association of the most loving family circle; an encouragement of a frequent interchange of acts of kindness; the inculcation of patience and repression of fretfulness over the most difficult task; the teaching of right views of life; the obligations of duty in its various relations; and the responsibility incurred by increased means of usefulness. Every hour affords opportunity for such teaching, which is thus incidental, illustrative of life's ever-recurring opportunities for varied lessons of practical wisdom, and powerfully impressive in its effect, without marring the force of the primary inculcation of which it is an incident.

Whatever improves the manners is of vital importance in moral education. I fear the need of this suggestion is of the utmost urgency in the present time. The precociousness, not to say the pertness and downright impudence of masculine young America, especially in cities, has its counterpart, in a certain degree and in some mode of expression, in the girls of towns. And the evil may be creeping into the country, and finding its expression in incivilities and pertnesses, possibly to result in mild rebellion against parental will or open defiance of parental authority. Decided candor and frankness, and a certain heartiness of expression, are commendable, and entirely compatible with self-respect and respect for others, which shall not permit anything that may wound the feelings of associates, or excite their envy or their dislike.

It may be said that these are the proper objects of home-training. So they are, but they should not on that account be ignored in school; both home and school should ever co-operate in all the objects of education; but, unfortunately, all homes are not blest with proper teachers, and it may be the happy fortune of model school instructors to be the means of reconstructing, in another generation, these unbalanced homes, thus promoting social harmony and happiness throughout the whole community. In the moral culture of the school-room care should be taken to exorcise the fell spirit of caste, the promoter of strife and foolish pride. In this country the daughter of a mechanic or plain farmer may be the wife of a President, and thus the superior in position of the wives of judges and senators; or the daughter of a town millionaire may become the humble occupant of a log cabin in the wilderness, or on the broad prairie. The position of the tiller of the soil is as honorable as any, but I would not recommend to farmers' girls the assumption of airs on that account, although a President of the United States once said: "If I could ever suppose that family pride were in any way excusable, I should think a descent from a line of virtuous, independent New England farmers for a hundred and sixty years was a better foundation for it than a descent through royal or noble scoundrels ever since the flood."

Assumptions of superiority are evidences of ignorance and vulgarity. A sensible girl in inferior company will not conceal her actual superiority, but her apparent consciousness of it. She need not, she should not, associate with unworthy persons, and she may not keep company with those of diverse tastes and uncongenial feelings, if she will avoid giving offence by open neglect, or worse still, unkind or contemptuous expressions or acts. Our social predilections are

unaccountably eccentric and unexplainable; some young persons are very general in their associations, others extremely select; and I have known some of the latter, who never have more than two or three intimates at once, to be universally popular with all, notwithstanding their actual exclusiveness. This is the true republican idea of equality—to give to all that courtesy and kindness to which they are ever entitled, and which no true man or woman can withhold, and then for special friendships and social companionships select those congenial spirits who alone may contribute to your happiness and edification. In law and in rights all are equal; in kindness and benefaction all should strive for supremacy; in affiliations of affection and in social communion exclusiveness is a sacred temple into which no one may enter unbidden.

PHYSICAL DEVELOPMENT.

This branch of culture has perhaps been more neglected than any other, and yet without it all other training is comparatively worthless. So far as the uses of this world are concerned, mind and soul are utterly valueless without a body, and domestic accomplishments must have a corporeal foundation. Health is a duty, and sickness, if not a sin, certainly the result of sin, according to Scripture teachings, human observation, and common sense. The effects of hygienic wrong doing, operating by descent and repressed by the wonderful resistance of the powers of life, are difficult to understand and may baffle our reason, yet we can constantly point to direct and immediate results of our habitual carelessness, if it is to receive no worse name.

The need of physical culture is beginning to be recognized, and the muscular is already sharing with the mental the attention of grave college professors and dignified matrons in charge of female seminaries. Attention to the importance of such education has been forced upon public teachers by considerations which could not be ignored.

Physical delicacy.—In the eastern States and in New York the daughters of townsmen and village residents, and even farmers' girls to an injurious extent, have fallen into sedentary habits, neglected wholesome outdoor exercise, suffered too early mental training and unhealthy stimulation of the nervous system, and the consequences are seen in an ominous precocity, delicate constitutions, shattered nerves, and a liability to all the diseases incident to the climate, to their sex, or to the accidents of life. Wherever one may go neuralgias, aches of every kind, and weakness of every name are more or less the subject of neighborly converse. The evil is cumulative, and has been progressing for two or three generations. There is reason to believe that more wholesome views are tending to turn this tide of suffering, and perhaps it is already on its ebb. Some writers have recently enlisted their pens in the practical philanthropy of preventing the slow murder of these innocents. Mrs. Stowe, writing especially for her own section, though the picture is more or less applicable to other parts of the country, says: "A young American girl of our times is a creature who has not a particle of vitality to spare, no reserved stock of force to draw upon in crises of family exigency. She is exquisitely strung, she is cultivated, she is refined; but she is too nervous, too wiry, too sensitive, she burns away too fast; only the easiest of circumstances, the most watchful of care and nursing, can keep her within the limits of comfortable health; and yet this is a creature who must undertake family life in a country where it is next to an impossibility to have *permanent* domestics. In fact, we in America have so far got out of the way of a womanhood that has any vigor of outline or opulence of physical proportions, that when we see a woman made as a woman ought to be, she strikes us as a monster. Our willowy girls are afraid of nothing so much as growing stout, and if a young lady begins to round into proportions like the women in Titian's and Giorgione's pictures, she is distressed above measure, and begins to make secret

nquiries into reducing diet, and to cling desperately to the strongest corset-acing as her only hope."

In the milder climate of the west there is perhaps more exercise in the air, nd especially more horseback and carriage riding; yet there is often in villages, nd among farmers, many of whom are wealthy, the same tendency to sedentary ife, and a still greater exemption from the wholesome cares of the household; nd there, too, similar results are visible.

Signs of improvement.—It is to be hoped that a reform may be entered upon t once, and there are evidences that it is already beginning to be inaugur-ted. An art journal in New York, whether sincerely or gallantly, suggests hat "the women of America are growing more and more handsome every year;" hat they are fuller of chest and gaining in substance and physical development enerally; and the change is attributed to open air exercise in the saddle, to earning to skate, to croquet, &c.

The improvement in the clothing of girls has of late years wrought a percept-ble sanitary change. I can call to mind more than one of whom it might lit-rally be said, "she died of thin shoes." Not many years since it was customary o go forth from stove-heated rooms to freezing external temperature with in-ufficient under-clothing and shoes with soles of paper-like tenuity. The change s radical in many particulars. To go back to such usages at the mandate of ashion would be suicidal. There are indications that our countrywomen have cquired sufficient practical wisdom to bend the fashions hereafter to some con-ormity with physiological principles.

Aids to health on the farm.—Does the farmer ask how a complete physical de-elopment of his daughters can be successfully sought? They have pure air, bundant food, and all the conditions of health. No crowded drawing-rooms or ate hours plant lilies in their cheeks. What more is wanted? Much more. irls have tastes and sensibilities as well as lungs and stomachs. Joy acceler-tes the pulses, and grief can arrest the very action of the heart. How often oes the pain of parting take away all appetite for food? The reason is that he stomach is temporarily deprived of its power to act upon it. The farmer's ife is one of comparative isolation; his daughter, tasting the social sweets of own society, pines for youthful company in her solitude, unless social intercourse s provided, the farm house made cheerful and pleasant, and its surroundings eautified with the arts of floriculture and landscape gardening. And the artist hould be the farmer's daughter herself, gaining health and strength and beauty mid the shrubbery and the favorites of Flora, the subjects of her care and raining. Cheerfulness and good nature, and all absence of irritation, are all ssential to health, as they affect digestion with the certainty of an active poison. roper amusements should be provided, frequent friendly visits interchanged, nd more time devoted to relief from sombre or absorbing engagements. Much nischief has been produced, in New England especially, by disregard of this ecessity. The boys and girls of a family should have more of their recreations nd employments in common. The wrong in this case has sometimes been harged upon the girls. There are two sides to this question. Mrs. Adams, in he Report of Agriculture for 1863, drew a touching picture of an only brother riven away from the cheerful voices and merry laughter of his sisters, from nder the feet and urgent industries of the notable maternal housekeeper, doomed o melt with his tears the falling snow flakes and listen vainly to the distant nusic of his father's axe from which he was separated by icy barriers, wonder-ng all the while "how God would punish women and girls who were so wicked o little boys." Reverse the picture and imagine the sadness and desolation of lone sister, whose burly brothers, rosy with physical exercise and jubilant in he enjoyment of freedom unrestrained, have cruelly refused her imploring emand to share with them the pleasures of nutting in the brown autumn woods, r in the early summer time the excitement of baiting the speckled trout in the

meadow brook, and all because (in the language of the young masculines so contemptuously expressed,) "she's a *girl*, and will only be in the way." Is it a wonder that she grows pensive and shy, and thinks God's sunshine is not for her, nor the sweet buffeting of His healthful breezes, nor the joyous companionship and sympathy of youth? Is it strange that she grows into the full belief of the selfishness and insensibility of the other sex, when her own brothers can treat her so?

Food.—Diet has much to do with health, and also something to do with mental condition. It is held to be an axiom that a gross feeder will have a gross mind. I doubt if true refinement of manners can exist in conjunction with an exclusive pork diet. It is certain, at least, that children will grow up more healthful and beautiful in families accustomed to a variety of well-cooked food than in those dieted upon invariable salt pork or smoked herring fried to the pliability of leather. In one case clear complexions and plump figures will be the rule, and in the other a leathery skin, angular features, lean forms, and irritable and selfish dispositions. There is great diversity in farmers' families in this respect. A large number combine the best known hygienic regimen—good cookery, fresh material, and variety with simplicity in mode of serving. Farmers have an advantage over all others in fresh vegetables, milk, cream, butter and eggs, and some disadvantages in variety and convenience of meat supplies, which can all be easily overcome, however, by provision of fowls, lambs, and a little neighborhood arrangement for exchange of other meats. On the other hand, there are farmers abundantly able to provide wholesome fare who live abominably, and their children are neither handsome, healthy, nor good-natured. Careful observation and a little reflection will teach them the importance of diet in *education*. A dyspeptic stomach can never rest, and without periodic repose both of stomach and brain, mental labor cannot long be performed. Late hours and excessive study at school produce mental exhaustion and affect the stomach directly by sympathy, and an improper diet aggravates the difficulty. Farmers who bestow so much attention upon the thrift and fattening of domestic animals should at least allow their children equally favorable conditions of health. It is indisputable that in many cases the cattle are the favored party and the children are neglected.

I am satisfied that with the mental and material progress for which this country is peculiarly characterized, the physical improvement of Americans will be equally marked, and that we shall become not only the most lithe and active, but the toughest, strongest, and best developed people in the world. We have the best elements of such a race and the best conditions for its development, and nothing but a lack of wisdom on the part of the people will prevent such a consummation.

DOMESTIC ECONOMY.

One of the indispensables in the education of girls, whether daughters of farmers or not, is a thorough knowledge of household economy. This subject embraces the acquisition of a knowledge of the various processes of the culinary art; the preparation and preservation of fruits and confections; the operations of the laundry and nursery; the skillful use of the needle; the care of the sick, and the culture of the kitchen garden and flower borders, should not be excluded from the list. This knowledge should be not merely experimental, but should include an acquaintance with the principles which should govern the processes of each department of domestic experience. For example, it is not enough for the farmer's daughter to know how bread is made, she should understand "the chemistry of bread making." The same science teaches the effect of heat, as it is variously employed upon meats—hence the best methods of cooking meats. The process of butter making involves the principle of the same science, a knowl-

edge of which is interesting if not absolutely necessary to success in the operation. A scientific knowledge of physiology and hygiene also has its best exemplification in the daily care of a household. Thus the commonest duties of the family will only illustrate most faithfully and fully the principles of science learned in schools, and education is made complete and symmetrical by the simultaneous culture and expansion of all the powers and functions of mind and body.

The incident of wealth, however great, constitutes no exemption from the necessity of a thorough domestic education. Perhaps the most formidable object of solicitude to the young housekeeper at the present day is that of domestic labor. A foolish prejudice has sprung up in the minds of American girls dependent on their labor for support, against household service, which they refuse on any terms, and accept routine labor in some species of manufacture, requiring long daily service, constrained or cramped positions, insufficient ventilation, and an expense for board that leaves a remainder too small to pay for the losses incurred, in comparison with wholesome, comfortable, well-paid housework. Thousands of girls are yearly killing themselves in large cities by overwork and insufficient pay, especially in the various departments of sewing. In manufacturing towns they are better paid, though often they are injuring health that would have been improved by household labor.

The evil is one of such magnitude as to attract the attention and command the anxious consideration of the most practical minds with a view to a possible remedy. Many a family has actually and seriously suffered by the deprivation of help, often in cases of long continued sickness, until kind-hearted neighbors have voluntarily neglected their own families, or friends have come from many miles distance, to render aid which money failed to purchase. Persons with abundant means to pay for service have been compelled to overtask themselves, even at the risk of life, in household labors and care of the sick which no one could be found to share. In the eastern States this difficulty has been at its maximum of late, and nearly the same state of facts exists at the west. Every expedient is adopted for partial relief; temporary help of the most nondescript character is accepted, and changes are of weekly occurrence, sometimes with intervals of days unblest with any assistance whatever. What is a young housekeeper to do if ignorant of domestic affairs in such an emergency? Her husband may, as a last resort, if in a city, seek refuge in a hotel or restaurant, but the young bride is in danger of starvation.

Fortunately there are few daughters of farmers whose domestic education is thus neglected. They may not realize, however, the full importance of a thorough knowledge of the widest range of domestic economy as practiced on the farm or elsewhere. They may be wives of farmers, of artisans, merchants, or professional men, and should be prepared for any station they may be called to occupy, though they cannot find one more honorable than that from which they spring

There is abundant room for progress in this branch of education, in the country as well as in the city. A tour through the land will reveal, in houses of all ranks of society, cookery which is the fruitful source of dyspepsia and its frightful train of ills. In the houses of many farmers, particularly in the west and south, where abundance is always present, however coarse the quality, how often are tough meats floated in grease and fried to the pliancy and color of leather, and served with biscuits like bullets, and of nearly equal destructiveness. Such viands are even more prejudicial to health than the gout-producing delicacies of the gourmand as they come from the skillful hand of his French cook. "While the Lord sends meats" almost with the profusion of the quails that fed the Israelites, it must be that "the devil sends cooks." The evil should be remedied. The faculty of any female college in the land is incomplete without some Professor Blot.

If the Arabs permitted divorce for ignorance of bread-making, their laws were

less inimical to good morals than are those of Indiana. A woman is a broken reed, who cannot, in the time of need—which is emphatically the hour of servant-girl absenteeism—produce the staff of life. Few kitchen girls can bake a loaf of bread of the first quality; many are able to make only the most wretched failures. It would not be extravagant to say that bad bread had destroyed more life than gunpowder—certainly produced more suffering. Whatever a woman's accomplishment or fortune, she cannot be certain of having wholesome food for her family unless she can, at least, teach practically the high art of bread-making. It is a prime essential in a young woman's education, for the lack of which no culture in other directions can compensate.

Many of those who have neglected this education in youth will be compelled to acquire it under circumstances the most disagreeable and inopportune, as in the case of a friend of a well-known American authoress, (Mrs. Sigourney,) who encountered a disheartening and mortifying experience in the west, but persevering, surmounted all obstacles, and became as accomplished in domestic affairs as in the learning of the schools. The following is a brief extract from her interesting description of her suffering, her conflict, and her victory:

"Household work cannot, as some imagine, be done *extempore*, nor is there a royal road to domestic economy any more than to any other art or science. I applied my strength, my mind, and my conscience to the business. I often failed, but I learned from failure as well as from success. Practice made that easy which at first seemed impossible. I can now dispatch a bit of work in the time I at first consumed in sighing over it, and I often find my hands are performing their work like machinery, while my mind is wandering over earth, sea, and skies. What a wonder-worker is habit! When we cannot obtain domestics, we do not now suffer. Such occasions are, however, rare. We can get rough Irish or Germans, and I know how to direct them, what to require of them, and where to assist them. They are well called '*hands*;' their employer must be '*head*' to them. And now, my dear friend, those branches of my education which, in my first despair, I thought utterly lost upon me, have assumed their right position, and household drudgery takes its subordinate place. * * * * I now feel the full value of my late domestic education, which enables me to enjoy with a quiet conscience, the elegant pursuits for which my early instruction alone qualified me."

CULTIVATION OF THE CINCHONA IN THE UNITED STATES.

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The object of the present article is to call the attention of agriculturists and others to the necessity for and advantage of cultivation in the United States of that genus of trees which yields Peruvian bark and quinine; and, in so doing, to give an outline of the natural history and chemistry of that family, to detail the steps which have been taken by other nations in the effort to obtain within their national limits a sufficient supply of that drug so necessary to all inhabitants of southern, temperate, and intertropical latitudes, and to demonstrate the imperative necessity on the part of the government of the United States of decided, active, and prompt measures to establish cinchona plantations within the domain of this great republic.

No apology is needed for pressing this subject upon national attention. There is no matter more becoming a free and peace loving people than the extension of the cultivation of products not hitherto found within our confines, n or any occupation which will conduce more to multiplication of life comforts and national riches.

It might at first sight appear but a small matter whether a sufficient supply of a certain vegetable product, and that an article of the materia medica, can be supplied in the regular course of commerce; but when it is considered as an admitted fact that its produce is yearly diminishing, the demand for its use yearly increasing, and that no medicinal substance has yet been found which can in any degree be a substitute for its action or supplement its virtue, it must be confessed that that government would fail in its chief function, and cease to merit the support of the governed, which would neglect to act in a case where the health of the whole community is so seriously interested.

Quinine and Peruvian bark are used for many more diseases than formerly, and have taken the place of many other remedies, such as the black pepper of the ancient Romans, the willow bark, the piperine, and the web of the black spider among modern people. Quinine is valuable, not merely for the cure of disease, although as a curative agent there is none which is so steadily advancing in medical favor, and whose application in treatment of all diseases, marked by debility arising from an ill-conditioned blood, is becoming so extended that there are few maladies in which its exhibition is not appropriate in some stage or another, but also for its *prophylactic* or protecting power against the approaches of disease from malaria. In brief, it preserves the health in the midst of an unhealthy soil and atmosphere. Its value as a means of warding off the attacks of intermittent fever is now so appreciated that the English admiralty have issued regulations for naval vessels off the coast of Africa, requiring that every man shall take quinine when the ship is within a certain distance of the east and west coasts of Africa, and that it shall be regularly continued in eight-grain doses every morning by those engaged in boat cruising along the coasts of the rivers and creeks of that continent. During the late war in this country the practice of administering quinine as a prophylactic was carried out on a large scale, having been commenced in the McClellan campaign on the peninsula, and continued afterwards to the manifest benefit of the health of both officers and men when administered in whiskey in the early morning with or without coffee. Under its influence thousands of men have been safely quartered on James island, opposite Charleston, during the malarial season, where formerly it was considered certain death to sleep out in the air for a single night.

The cinchona genus belongs to a natural order of plants, the rubiaceæ of Jussieu, which has already given to man coffee, ipecacuanha, and madder. The true cinchona trees flourish from 10° north latitude to 18° south of the equator, in South America, at an average elevation of 6,400 feet above sea level; the fine barks are found between 7° north and 15° south, and range from the height mentioned to 11,000 feet of elevation; below six thousand feet cinchonas rarely descend; the *ladenbergia*, an allied genus, descends to nearly 4,000 feet of elevation; and another allied genus, the *exostemma*, descends even to the sea level.

The native habitat of the genus is in the mountain region of South America, a vast tract of country extending for hundreds of leagues eastward from the Peruvian Andes to the confines of Brazil, and consisting of vast impenetrable forests whose silence has never been disturbed by the civilized explorer, and where savage inhabitants are so unfriendly as to repel all the advances of civilization. The tribe called *Chunchos*, living on the headwaters of the Purus, have either murdered or driven away all the settlers, so that in the rich valleys of Paucartambo not a single settler remains since 1861, and the rich Spanish farms scattered everywhere around have been swallowed up by the advancing tropical forests which grow with amazing rapidity. These forests consist of huge trees, some having beautiful wood, some valuable gums and resins, and others consti-

tuting fine timber; a rank undergrowth or jungle covers the whole country, and the stems of the trees are interlaced and woven together by festoons of creeping, closely matted parasites. Besides the bark tree, here is found the India-rubber, vanilla, copal, cinnamon, balsam, indigo, copaiba, ipecacuanha, sarsaparilla, vegetable wax, coffee, and cotton, and a host of other valuable species.

It is remarkable that the cinchona genus occupies so small a space of the forest world; as far as known, it does not occur in nature in equatorial Asia or Africa. On this continent it extends no further than the limits above stated, and has not yet been found in North America. Within the range of over 1,800 miles the species never descends nearer to the sea level than an altitude of 2,500 feet, and thence reach up the mountain sides for several thousand feet of altitude; above this high limit are low alpine shrubs, and below the lower limit are forests of bamboo and palms. Within the zone occupied by the cinchonas are the tree passion flowers, melastomaceæ and arborescent ferns. That they may with advantage be cultivated in other localities has been long the opinion of those naturalists who have visited the native forests where they abound.

Humboldt has pointed out, outside of the geographical limits stated, other regions of South America which possess suitable conditions of climate for the growth of these trees—as the Silla de Caraccas, and a few mountain ranges of Cumana, also some portions of Mexico; and he suggested that the low tracts of land which intervened between the lofty mountains of Cumana and the region of the Andes, and between Cumana and Mexico, have prevented the cinchona species from crossing over and spreading northward.

In good soil and favoring climate they become large forest trees; when crowded and on rocky ground they become thin, tall, and without branches below, and when at the upper limit of climate they dwindle into shrubs; the leaves are long, uniform in shape, generally lanceolate, with a shining, bright green surface, traversed by crimson veins, and petioles of the same color. The flowers are very small, hanging in clustering panicles like lilacs, of a deep roseate hue, pale at the stalk, and dark crimson within the tube, with white curly hairs bordering the laciniæ of the corolla, (Markham.)

The various species of the genus do not appear to mix, but preserve their localities in respect to elevation and latitude quite distinct. Taking them in order, the cinchona calisaya has been found furthest south in Bolivia and Caravaya up to 12° south latitude; thence for 2° north no valuable species have been found; then comes the Huanaco region, in northern Peru, in which the gray barks are to be found; further north is the Loxa region, in which the brown barks predominate; the Chimborazo region succeeds, in which the red bark species abound; and lastly, most northerly is the New Granada region, containing chiefly the cinchona lancifolia. Thus there are five distinct regions, in which as many different species occur.

Mr. Howard believes that every well-defined region of the Andes has its own prevalent and characteristic cinchona which is not capable of being reduced to any one typical form, and that no species has been clearly proved to prevail unchanged from end to end of the cinchonaceous region, so that the forms which resemble each other in distant parts will be found analogous rather than identical. In these native forests the species are becoming scarce, and owing to the cupidity of the bark hunters and the neglect of the proprietors, the cinchonas are fast disappearing. No effort is made to replace the trees which have been felled, and in the act of cutting down no thought is taken to allow of space in trunk for young shoots to spring from. Mr. Buckalew, now United States senator, formerly minister resident at Ecuador, (1858–'61,) writes that the trees of cinchona *succirubra* are getting scarce before the depredations of the *cascarilleros* or bark hunters. "There is not one tree," he writes, "probably in cultivation or domesticated in the republic of Ecuador, and it is not found elsewhere."

Don N. Lorenzano, the owner of extensive cinchona forests near Bogota, states,

however, that the indiscriminate cutting of trees mentioned by travellers occurs only in the forests of Pitayo; that the usual plan which he and others follow is, to leave about three feet of trunk above-ground unstripped, whence shoots arise, and then clearing the ground so as to admit the light and sun, and thus allow the seeds of valuable varieties to germinate freely, and that by this means, in Peru, Bolivia, Ecuador, and New Granada, a fixed plan of cutting is preserved. This, however, is doing very little to propagate a genus whose number is at present so insufficient that England alone cannot obtain from Peru a sufficient supply of bark to manufacture quinine from.

The process of removing the bark is thus described by Pereira, whose remarks are abridged here: The name of *cascarilleros* is given not only to the men who bark the trees in the woods, but also to those who are in any way specially engaged in this commerce. The bark is chiefly gathered during the dry season, and the operation is commenced by sending in front an experienced (*practicos*) man of the cascarilleros to prospect the country, and determine the locality where the trees abound in greatest number, for the cinchonas rarely constitute an entire forest, but grow in more or less compact groups called *manchas;* occasionally only one tree grows here and there sporadically. It is on this latter account that much skill and experience is shown by the cascarilleros in separating out of the dense mass of foliage which such forests display, the few cinchonas which may be scattered through it. The inspection of the trunk, the aspect of the foliage, the form of the tops of the trees, and the peculiar character which the inflorescence communicates to the cinchona, all serve to the anxious Indian as so many guides in his weary search for these desirable trees. When selected the whole tree is generally felled a little above the roots, which are then cleared of earth, and the bark of the roots removed so long as any thick bark is yielded from the root. The bark of the stem is then beaten with wooden mauls or hatchets until the peridium or outer bark is loosed. The inner bark of the stem and branches, after being freed from the outer bark, is placed over a gentle fire, and dried for a few weeks, by which operation it loses about two-thirds of its original weight.

The bark of the branches only is selected in northern Peru and Ecuador, while in southern Peru and Bolivia it is taken from the stem and branches. In the warmer seasons the drying is effected by simple exposure to the sun. Pasteur thinks this process by the sun diminishes the quantity of alkaloid obtained. The collection of bark takes place in New Granada in all seasons of the year, owing to the cupidity of the cascarilleros; in Peru and Bolivia it is, as stated, gathered only in the dry season.

There are many trees and shrubs allied to the genus cinchona which have been mistaken for the true plant, and have been sought after and the bark collected instead of the cinchona proper. Thus the brown barks of Loxa, which at one time bore a high value, have become almost a rejected sample in the market, owing to the adulteration and substitution practiced before it left the South American port. The bark of many of the species ladenbergia is collected and palmed off as cinchona. Shortly after Linnæus established the genus cinchona, Endlicher divided it into two sub-genera, one of which he named *quinquina*, (from the Indian word *quina*, which, in Quichoa language, signifies a "bark," the doubling of the words implies its excellency or its medicinal use,) in which the dehiscence of the ripe capsules is from below upwards; the other, *cascarilla*, in which the dehiscence of the fruit is from above downwards. Weddell subsequently raised them into the two genera *cinchona* and *calisaya*, and most writers prefer to follow him. The distinction would appear trivial were it not that the proper cinchona alkaloids have hitherto been exclusively found in the species of the first section or genus, and which therefore are the only genuine cinchona plants.

The modes of classification of the genus have led to much confusion. In the beginning it was deemed sufficient to distinguish the few varying kinds of the cinchonidœ by the prevalent form of the leaf, as cordifolia, lancifolia, oblongifolia,

&c., a plan which has grouped together essentially different plants. Then the classification by the color of the bark has led to equal confusion, for the gray bark of Huanaco *(C. micrantha)* gives an abundant yield of pure cinchonine, while *C. micrantha* of Bolivia differs widely in its chemical constitution. The *C. ovata* of Peru is a worthless bark, producing only aricine, while the *C. ovata* of Bolivia is a plant allied to the calisaya and rich in quinine, (Howard.)

There are three characteristics by which the true cinchona may be known, viz:

1. The presence of the curly hairs on the laciniæ of the corolla.
2. The peculiar mode of dehiscence of the capsules from below upwards.
3. Little pits at the axils of the veins on the underside of the leaves.

These distinctive marks separate the genus from every other, and although apparently trivial and artificial distinctions, yet they mark a distinction in the chemical life of the genus, as it is only such that coexist with the medicinal alkaloids.

In their native forests the cinchonas are evergreen trees or shrubs of various size, some sixty feet high, with shining obovate leaves of a deep green surface and glazed appearance; in flowering season they are conspicuous objects, the white or pink flowers being in cymes, and of a very fragrant odor.

The true cinchona barks are in commerce divided into the gray, the yellow, and the red. They all come either in rolled quills (*canutos*) or in flat, hollow oblong pieces, having variable dimensions, *(tablas.)*

The gray barks have five species enumerated: Huanaco, Loxa, pseudo-Loxa, huamelies, and pale iacu.

The yellow barks have as the important species the ringo or royal bark, (brown bark,) three varieties: calisaya fina, calisaya morada, and calisaya filma.

The red barks have two valuable species enumerated: Cinchona suberosa and cinchona succirubra.

The false cinchona barks are chiefly derived from the genera ladenbergia and exostemma. They abound in Peru, New Granada, and Brazil.

The amount of cinchona bark exported by the South American states must be immense, and the total export consists of bark alone, since there is no manufactory of quinine for outward consumption in any of the above-named countries.

Dr. Royle in 1852 estimated that the East Indian colonial consumption of quinine amounted to £7,000, but its use in a few years after must have been vastly augmented, for a writer in the Edinburgh Review for October, 1863, states that the expenditure for quinine in the year 1857–'58 amounted to £54,500, or above a quarter of million dollars for one British colony.

The consumption of quinine and bark has rapidly increased in this country, and the influence of the late war upon its importation has been marked. The subjoined tables, extracted from reports of the Secretary of the Treasury on commerce and navigation, show the amount of import of both bark and quinine, with the quantity supplied by various foreign countries:

Bark—Peruvian, cinchona, Leina, and calisaya.

	Quantity in pounds.	Value.
In 1859–'60	....	$449, 575
In 1860–'61	....	158, 327
In 1861–'62	621, 096	319, 843
In 1862–'63	518, 728	380, 736
In 1863–'64	....	422, 142
In 1864–'65	492, 052	143, 489
Total in six years	1, 631, 876	1, 874, 112

Sulphate of quinine, and all other salts of same.

	Pounds.	Ounces.	Value.
In 1859–'60	147	......	$3, 617
In 1860–'61	68	......	983
In 1861–'62	5, 525	......	126, 843
In 1862–'63	......	......	86, 907
In 1863–'64	......	......	42, 488
In 1864–'65	......	21, 443	26, 300
Total in six years	7, 526	11	287, 138

Table showing the ports or countries supplying the United States with Peruvian, cinchona, Leina, and calisaya barks.

Country.	1859–'60*	1860–'61*	1861–'62.		1862–'63.		1863–'64.	1864–'65.	
			Pounds.	*Dollars.*	*Pounds.*	*Dollars.*		*Pounds.*	*Dollars.*
Hamburg & Bremen						14, 333	$1, 249		
Holland						1			
England	$195, 432	$69, 671	280, 222 50, 747*	192, 847 16, 254	113, 249	97, 300	118, 694	5, 156	1, 879
Canada						245			
British West Indies		3, 875				21, 865	718		
British East Indies						335			
France	27, 691	29	8, 996	2, 691		2, 301	144	1, 281	398
Spain	2, 037				497	199	1, 522	9, 020	1, 144
Spanish West Indies						962	13, 463	156	27
Austria						164			
Mexico						5, 416			
New Granada	197, 242	63, 588	242, 532	98, 760	394, 073	236, 126	286, 352	476, 439	140, 041
Brazil						77			
Buenos Ayres			171	40		1			
Chili	17, 852	21, 029	8, 428*	278*	909	549			
Peru	9, 321								
Liberia						802			

* Free of duty.

Table showing the ports or countries supplying the United States with sulphate of quinine, and all other salts of same.

Countries.	1859–'60.		1860–'61.		1861–'62.		1862–'63.	1863–'64.	1864–'65.	
	Ounces.		*Ounces.*		*Pounds.*				*Ounces.*	
Hamburg & Bremen	1, 330	$2, 767	134	$176	500(?)	$10, 952	$13, 561	$833	2, 685	$3, 258
England	417	706	10	16	3, 620	85, 704	61, 588	41, 172	14, 458	17, 603
France	20	44	29	53	1, 375	29, 683	8, 007	34	3, 500	4, 169
Spanish West Indies			640	738			3, 750	449		
New Granada					20	383				
Russia					10(?)	176				
Canada							1			
Holland									6	14
British West Indies									75	124
Mexico									99	325
Brazil									620	806

The influence of the late civil war upon the consumption of quinine is evident from an inspection of the foregoing tables. The Surgeon General has communicated to the writer the following statement of the consumption or purchase for the use of the United States army from January 1, 1861, to December 31, 1865:

Sulphate of quinine	595, 544	ounces.
Sulphate of cinchonine	343, 226	"
Powdered calisaya bark	259, 258	"

The history of the knowledge of the intimate chemical composition of these barks reaches back for more than half a century, when Fourcroy in 1791 published an analysis of San Domingo bark, (one of the false cinchona.) Seguin thought the active principle must be gelatine, and recommended that substance as an intermittent. Duncan separated some principle which he called cinchonia. Van Julien experimented laboriously without much result. Gomez, in Lisbon, separated cinchonia in a crystalline form; in 1820, Pelletier and Caventou separated quinia as well as cinchonia; nine years later aricina was separated, and in the same year (1829) Serturner announced the existence of quinoidine, which Liebig in 1846 stated was amorphous quinine, but which a Dutch chemist, Van Heigninger, in 1849 and 1850, separated into two varieties of quinine, A and B. Pasteur has since experimented upon this substance, and traced the change which occurs by the oxidation of the alkaloids. Of the organic constituents of the cinchona genus there are, as now understood—

1. Alkaloids.—Cinchonine, quinine, cinchonidine, aricine, quiniodine, quinidine, cinchonicin, quinicin.
2. Acids.—Kinic, tannic, kinovic.
3. Coloring matters, (probably oxidation products of the acids.)—Red, yellow, green.
4. Fat.
5. Starch.
6. Gum.
7. Lignin, cellulose.
8. Saline matters.

The order of enumeration of the bases given above is, I believe, the natural one; thus, that the cinchonine is the first and perhaps the only alkaloid in the early-growing plant; it changes in the sap of the leaves into *cinchonidine* and *quinine;* quinine changes into quinoidine; it into *quinidine*, and the latter, in its turn, into quinicin. These changes occurring slowly and cotemporaneously, lead to the existence of all these alkaloids in, perhaps, one plant.

It is, perhaps, not generally known that the preparation commonly known as quinine, or sulphate of quinine, is not that salt which exists naturally in the bark of the trees. The active principle *quinia* abounds in all true barks, but most of all in the succirubra—that is, its absolute quantity is not only greater, but it is also in larger relative quantity than in other varieties; it is, in fact, less admixed with cinchonia and other alkaloids. The quinia is in the bark united with acids called the cinchonic, tannic, and kinic, which themselves are in part products of decomposition of the alkaloids, first produced in the leaves and becoming deoxidated in the early life of the plant. The mode of obtaining the alkaloid quinia depends, first, upon separating all of the active principles of the bark from pre-existing combinations by the force of affinity of a powerful acid. The bark is macerated in dilute sulphuric acid, by which sulphates of all the alkaloids are obtained; the clear solution of these being treated with lime throws down all of the alkaloids in a comparatively free condition, but admixed, and they are separated by treating the mixed alkaloids with ether and alcohol, which, by dissolving one alkaloid, enables it to be drawn off and recrystallized. Quinia thus obtained is then united with dilute sulphuric acid, and pure crystals are readily formed. The consumption of alcohol in this manufacture is very large, and the high tax on its manufacture has been, in this country, a serious obstacle in the production of the salt.

The chemical history of the cinchona plant furnishes two interesting occurrences. First, it was in a series of experiments which were planned by Mr. Perkins, in England, who was working on *apiol*, a substance derived from petroleum, in order to obtain quinine artificially, that some of the most beautiful series of rosaniline compounds were discovered; and secondly, it was during a series of experiments by Drs. Dupré and Bence Jones, who were endeavoring to ascertain

if quinine could be detected in the blood by Stokes's test of fluorescence after that medicine had been taken into the system, that the astounding fact presented itself to them that either quinine itself, or some bitter substance so resembling quinine that it responds to all chemical tests in a like manner, already exists in the healthy blood, and that such is most probably the bitter principle of the bile of animals; whence it follows that when we give quinine as a medicine we are but adding more to what already exists in the body, or what should naturally exist, and the want or deficiency of which may produce the condition of ague and other periodic diseases.

The precise period and the manner in which the healing virtue of cinchona was discovered is enveloped in considerable mystery. Geoffry relates the tradition of the Indians having been cured of ague by drinking of the pool into which some cinchona trees had fallen. De la Condamine relates that the Indians observed that the American lions when sick with chills ate the bark off the cinchona trees. On the other hand, Ulloa and Humboldt believe that the first knowledge of its virtues was found out by the Spaniards, and that the Jesuit fathers were the first to suspect its healing power and to administer it to the sick. It was imported into Spain in 1632, but no trial of it was made until 1639.

"It would be strange indeed," writes Markham in his Travels in Peru and India, "if, as is generally supposed, the Indian aborigines of South America were ignorant of the virtues of Peruvian bark; yet the absence of this sovereign remedy in the wallets of itinerant native doctors who have plied their trade from father to son since the time of the Incas, certainly gives some countenance to this idea." This assumed ignorance of the Indians of the value of cinchona was probably intended to deceive the invaders, and thus it was more than half a century after the arrival of the Spaniard before the secret virtues of the bark were communicated to him. Be this as it may, this most precious of anti-periodics was soon used by the Spaniards in the vicinity of Loxa, and through the active agency of the Jesuits was established as a permanent remedy for all intermittents.

Its extension beyond the limits of the American continent occurred thus: The aged Aña, countess of Cinchona, descendant of a noble Castilian house, and time honored as being the wife of two successive viceroys of Peru, was suffering from fever in 1638, when her physician, Juan Del Vega, received a parcel of powdered quinquinia bark as a sovereign remedy for tertian fever. He administered it to the countess, who rapidly recovered. Two years later the viceroy and countess, returning to Europe, carried the bark thither, and thus introduced it into Spain, where Del Vega sold it for 100 reals per pound at Seville. As a token of respect for this introduction, Linnæus named the genus "*cinchona*," which was still further extended so as to include allied species, under the name of "*cinchonacæ*."

From the earliest trial of the medicine in Europe Peruvian bark was a success, increasing in medical favor, and the discovery of the active principle of the bark *quinia* led to a still more extended use of the drug both in its crude and manufactured forms. The acknowledged virtue of the bark soon led to explorations to ascertain its locality and open up a constant and sufficient supply for European wants. In 1777 the Spanish government sent out an expedition under MM. Ruiz and Pavon, who subsequently wrote the "Flora Peruviana and Chiliensis," published in Madrid, 1798–1802. Previous to this latter date (1792) Ruiz published his "Quinologia," to which a supplement was added a few years later by Ruiz and Pavon. Mr. Elliot Howard, than whom there is no greater living authority on this botanical species, published, a few years back, a new edition of the "Nueva Quinologia" of Pavon, in which he enumerates as many as thirty-nine species of cinchona, illustrated by the beautiful plates of Mr. Fitch. Dr. Weddell, under the sanction of the French government, published, in 1849, his great work "Histoire Naturelle de Quinquinas," illustrated by a series of beautiful plates figuring the different species, chiefly the result of his travels in South America.

To the English are due the first and, indeed, the only successful attempts at acclimating these valuable trees. Efforts had been made by other nations previously, as by the French and the Dutch. De la Condamine, a member of the French expedition of 1735, designed chiefly to obtain astronomical results for geodesy, not only was the first who described the cinchona living in its native forests, but was also the first who attempted to transport some young plants to Paris. In this he failed, as the box with the live plants was unfortunately washed overboard, after he had faithfully watched over them for eight months. The French government, under the reign of Louis Philippe, sent Dr. Weddell, a gentleman of extensive scientific knowledge, and well qualified for the mission, to South America with the special object of obtaining full information concerning the cinchona trees. He made two voyages, and thoroughly investigated the districts of Bolivia and southern Peru in which the forests exist, and brought home with him a small parcel of seeds of the cinchona calisaya, one of the most valuable varieties of the species. These were sown in the Jardin des Plantes in 1848, and young plants raised from them, which were distributed, and some of them were planted by the Dutch government in Java, upon their settlement, on a range of forest-covered mountains which had been laid out for the cultivation of the cinchona, for which it seemed well adapted. From very many causes, this experiment of the Dutch, the first made on the eastern continent, has not been as fully successful as it might have been; and as the conditions which led to this imperfect success are now very apparent, it may not be inopportune to state them here, since even failures are valuable when they point out the road to success. In the first place, the selection of plants made by the Dutch for their Java plantation was most unfortunate, containing, as it did, so many species wholly worthless as quinine-yielding plants—the cinchona *pahudiana* being one of them, which figures in their collection to the extent of many thousands. Secondly, the habits of the genus had not, at that time, been duly studied, and due care was not given to those circumstances which are most favorable to their full development. The Dutch introduced only two good species into Java, and after six years of cultivation, having commenced planting in 1854, had only 8,454 plants of quinine-bearing species, while the numbers of cinchona *pahudiana* were almost countless—a species already alluded to as utterly worthless. The Dutch, at first, planted at too low an elevation, in a very poor soil, and exposed to the full glare of a tropical sun. They soon found out the mistake made, but the superintendent, Dr. Junghuhn, then went into the opposite extreme, cultivating his plants under the shade of belts of forest trees, where they grew up rapidly, tall, thin, and spindle-shaped. Experience in the gardens in the East Indies has demonstrated that, while the tender plants require some shelter from the scorching sun, during their early youth, the open air and free exposure to the sun is best for the healthy plants when fully rooted, and, therefore, that the shade of timber or forest, close to the plantations, acts injuriously; thus placed, the plants grow luxuriantly, produce an abundance of seed and a fine thick bark, which, after sun exposure, yields a large percentage of alkaloids at the end of six or seven years; while those which grow in the shade, although much taller, are less rich in the medicinal bitter. By the practice of growing plants under the shelter of the forest, they are longer in coming to maturity, or until they may be made to yield their first tribute of bark. In the Java plantation it was estimated that it would be forty years before the cinchona trees would be fitted for losing their barks, while in six and seven years, on the East Indian plantations, trees grown in the open air have attained sufficient dimensions to justify the removal of some of their bark. As a commercial speculation, and as an incentive to individual enterprise, it makes considerable difference whether a plant cultivated is going to yield only *one* harvest in a lifetime, or whether it will give three or four; and the result of the Malabar plantation has been successful in the respect of proving itself a remunerative branch of agricul

ture, so much so, that there has been a constant and growing demand for young plants and seeds, on the part not only of English residents laying out plantations on the spurs of the Ghauts, but also of the native rajahs and influential Indian population, who are, in many cases, intelligent and energetic business men. A Mr. Vincent, an Indian planter, secured 5,000 young plants from Mr. McIvor, superintendent of the garden, and Mr. De Fanier also purchased a similar number in 1863. This amount is amply sufficient for the largest plantation, for, after a few years' growth, each plant is capable of forming an immense number of cuttings. Mr. McIvor obtained as many as 900 healthy cuttings from one six-year-old tree; he grows the young slips in brick-dust, placed in very small pots, where they remain till they recover from their severance from the parent stock, when they are removed to larger pots filled with powdered feldspar and loam. But to return to the necessity for free light and air upon growing cinchona trees.

All authorities upon cinchona cultivation, except Dr. Junghuhn, of Java, are agreed that the trees should be planted in the open air, away from shelter, and where they can have abundance of sunlight. "When planted in the open air," writes Markham, "cinchona grows luxuriantly, yields abundant supplies of seed, and forms fine, thick bark, which, owing to the free exposure of the leaves to the influence of light and fresh air, contain a large percentage of alkaloids." This, also, is the opinion of Weddell, Spruce, Howard, McIvor, and Cross. There is no doubt that trees grow tall and look well under the shade of a forest clearing, but experience shows that such are deficient in the relative amount of alkaloids in the bark. Markham also states that it is a well-established fact that all the species of cinchona trees produce the thickest bark, and the largest percentage of alkaloids, when growing at the highest elevation at which they respectively flourish. "Thus," he writes, "all other circumstances being favorable, the *C. calisaya and C. succirubbra* species will yield more profitable crops when growing at an elevation of 6,000 feet, than at one of 5,000 feet." These are eminently trees of the shrubby varieties, which in these conditions produce a bark much thicker than is usual. Mr. Spruce had also found out of the "red barks" that the higher the elevation at which the tree grows, the larger is the amount of alkaloid present, and the thicker, relatively, is the bark—the trees growing in or near the plains having a very thin bark.

Mr. McIvor attributes the unusual thickness of the bark to the presence of a large number of healthy leaves which throw back into the bark a large quantity of highly-elaborated matter. In this "matter" are found the alkaloids, the abundant supply of which depends on the vigorous action of the leaves, in consequence of a sufficient supply of sunshine. The effect of the open-air cultivation is to give them a shrubby form with a thicker bark; the older the bark the greater amount of alkaloids, relatively. Thus, the trunk or *tabla* bark yields a larger percentage of quinia than the small bark of the branches; but as the former collection implies the destruction of the trees, while the latter only means an annual harvest, the choice of practice is now in favor of the yearly supply and the preservation of the trees. Mr. Howard has expressed an opinion that a large produce may be obtained annually by growing the cinchona as shrubs.

To Dr. Forbes Royle is due the credit of first suggesting to the English government the great value of transplanting the cinchona trees to the East Indies, where quinine was so much needed on account of the malarious nature of the climate. In 1839, in his "Illustrations of Himalayan Botany," he recommended the introduction of the genus, and pointed out the Neilgherry and Silhet hills as the most proper site for the experiment; but it is difficult to move governments, and the *first official* proposal was made in a despatch from the Indian governor general, dated March 27, 1852, nearly thirteen years afterward. This was referred back to Dr. Royle, who reported, in June following, that, "to the Indian government the home supply of a drug which already cost £7,000 per year,

would be advantageous in an economical point of view, and invaluable as affording means of employing a drug which is indispensable in the treatment of Indian fevers. I have no hesitation in saying that, after the cinchona trees, no more important plant could be introduced into India." This intended action fell through from listlessness on the part of the officials; and Dr. Royle, undeterred, in May, 1853, drew up a long and valuable report, and again, in March, 1856, made a final fruitless step to influence the Indian government to take the needful measures to secure the plants. The death of Dr. Royle soon followed, and nothing further was done until 1859, when Lord Stanley, as secretary of state for the colonies, took efficient measures to carry out Dr. Royle's plans. To the selection of Mr. Markham perhaps is due the full success of the enterprise, who combined in himself the requisites essential for carrying out the great undertaking.

In 1859 Mr. Markham was intrusted, by the secretary of state for India in council, with the duty of superintending all the necessary arrangements for the collection of cinchona plants and seeds of the species esteemed in commerce in South America, and for their introduction into India. His efforts would scarcely have been crowned with the singular success which followed, had it not been for the skillful services of Mr. Richard Spruce, a professed botanist, who had been for some years previously engaged in exploring the basin of the Amazon from Para to the mountains near Quito, and from the shores of Venezuela to the headwaters of the Huallaga. The services of Mr. Robert Cross were hardly less valuable; he had been a gardener at the royal gardens in England, and was sent out to aid in the packing and transportation of seeds and young plants, under the instructions of Mr. Markham. On the 5th of December, 1860, Mr. Cross, with Dr. Taylor, alluded to subsequently, commenced lifting the young plants at Limon, in Ecuador, which was done with care, so as not to injure a fibre, and then packed them in cylindrical baskets, shaped like a cask, but open at both ends; the plants were all placed in the baskets, with the roots one way. In packing, the leaves and stems were carefully enveloped in moss, procured from the adjoining forest, and previously well dried in the sun; damp moss was placed round the roots, and then bound firmly together. Fifty plants were put in each basket, having been previously bound with the trailing stems of "Sogus" (Bignonias and passion flowers.) They were then carried on mules to Ventanas, and there by river raft to Guayaquil; there the plants were put on board steamer. The plants had been placed in sand and compost at Ventanas. Until the departure on the voyage, the cases were opened daily, and the plants exposed to sun and air. The plants were carried to Panama, thence across the isthmus, and transferred to the steamer at Aspinwall for St. Thomas, and thence to Southampton, whence they were carefully forwarded by the overland route, *via* Suez, to Calicut, where they were landed and carried overland to the settlement on the Neilgherry mountains, from 80 to 100 miles distant from the coast, where the climate is temperate and very moist for many months of the year.

The Neilgherry mountains are ranges of hills in the Malabar country, in north latitude 11° 10′ and 11° 32′, and longitude east of London 76° 59′ and 77° 31′; they are not a single chain, but a series which, with the Koondah range, run from the coast toward the interior, and serve to partially connect the eastern and western Ghauts. Dodabetta is the highest peak, about 8,640 feet of elevation. The hills rise from the plains from 4,000 to 5,000 feet, and are chiefly composed of primary and plutonic rock, as syenite, hornblende, with basaltic and quartzose veins; the plateau at the base of the hills is an undulating country from 2,000 to 3,000 feet high. The hills being exposed to two monsoons, yearly receive the rains of both, amounting to 70 inches. In the centre of this plateau is Ootacamund, close to which is the site of the first Indian cinchona plantation. The grounds had been cleared and ready beforehand, for the reception of the seeds and plants, by Mr. McIvor, into whose care they were delivered. They could not have fallen into better hands. There had been forwarded by Mr.

Spruce 529 plants, 1,000 cuttings, and at least 100,000 dried seeds—the whole put in wardian cases. The plantation was commenced in February, 1860.

The report of Mr. William G. McIvor, superintendent of cinchona cultivation in the Neilgherry hills, made to the colonial government in 1862, furnishes interesting matter with regard to the care and skill required and displayed in establishing the plantations. The first experiments in sowing seeds were purely tentative, there being no previous information on the subject which could be attained, and many seeds were lost at the outset by being sown in too moist and retentive a soil. Carefully prepared and burned earth proved to be the best germinating bed, and the period of nine weeks was the usual term of sprouting, with an earth temperature of 70° F. In 1862 the best mode of germination was found to be with a bottom heat of 72°, burnt earth slightly moistened, the seeds laid on top and covered over with a layer of sand, and never really watered—damped lightly with a syringe. Under this treatment 60 per cent. germinated in twenty-nine days after sowing, in March. As soon as the seedlings and imported plants attained sufficient size they were propagated by being layered. These rooted readily in six or eight weeks, giving off shoots from every bud; lateral buds were developed, and a good growth of young wood produced for succeeding layers and cuttings. As soon as sufficient young growth was formed, then propagation by cuttings was adopted, the earth being prepared in the same manner as for seeds, but without heat being applied to the earth.

Mr. McIvor being anxious to procure the largest possible number of plants in the shortest space of time, next adopted the method of propagation by buds, with the most immediate and satisfying success, many of the buds of the red bark and of the calisaya rooting without leaves. This was the practice in-doors and under glass, and a similar system was adopted in nurseries in the open air, in which, however, rooting was delayed two or three weeks longer, owing to the impossibility of keeping a uniform condition of the atmosphere. The superintendent commenced planting out in plantations in May, 1861, and nine months after it was found that those which were planted in the shade of forest timber suffered thereby, the rootlets of the forest tree filling up the holes of the cinchona hills, and choking away the nourishment from these shrubs, while those plants which were freely exposed to sunlight throve well. It is not well, however, to have the soil wholly exposed, since the plants will then suffer in their roots from the earth being baked by solar heat in the day-time, and cooled down by terrestrial radiation on clear and starry nights. The plants were placed at first in rows ten feet apart for large, eight feet for medium sized, and seven feet for shrubby sorts. This is not deemed sufficient distance for allowing the trees to obtain their full growth; but as they grew they were thinned out and pruned, and a fair maturity of plant expected in twelve years.

The next plantation established in India was at Darjhieling, north of Calcutta, in latitude 27°, in the Sikhim district, at the foot of the Himalaya range. Five different locations, at different heights on the hills, were selected, varying from 1,800 to 4,000 feet above sea level. The rains fall mostly in summer, and average 150 inches annually. The plantation was commenced June 1, 1862. On the 15th of June, 1863, the number of plants growing was 6,530; and on October 31, 1865, 108,962. The species chiefly cultivated are *Succirubra*, *Calisaya*, *Micrantha*, *Officinalis*, and *Pahudiana*. The great bulk is made up of the *Officinalis*, of which there were over 19,000 in February, 1865.

A cinchona plantation was established near Candy, in Ceylon, at Hakgalle, which was intrusted to the care of Dr. Thwaites, director of the royal botanical gardens at Peradenia. Hakgalle is 6,210 feet above the sea, with a climate abundantly moist, and of an annual temperature of about 59° F. The first seeds arrived in February, 1861, from the Neilgherries. In August, 1865, the number of plants growing was 75,250, the chief varieties cultivated being *Succirubra*,

Officinalis, and *Calisaya*. Hakgalle is a very flourishing garden, and becoming a large centre of distribution and sale of young plants.

Mr. Markham visited the plantations at Hakgalle in 1865, and reported to the Indian government. He approves of that site as well chosen, in its resemblance to the South American habitat of the cinchonas. He also states that, of the many thousand trees planted out on a bare slope at Rothschild, exposed to the full influence of light and wind, the great majority are flourishing and robust. Mr. Markham was instructed to induce the coffee planters of the Malabar coast to enter into extensive cultivation of these trees, a market for which will soon be formed by the opening of a quinine manufactory established by the Madras government, on a most extensive scale.

From the foregoing results in India, it is evident that the cinchonas suffered nothing by transplanting. Indeed, Mr. Markham is of opinion that the cinchonas are certain in India to excel the parent plants in South America in the yield of valuable alkaloids, and they have improved so much that inferior species in India vie in their products with the most valuable in Peru and Bolivia. He also states that not only do the young prunings yield large quantities of quinine, but by encouraging the growth of moss and lichens on the stems, the quantity of the alkaloids is much increased; and also that, if the fresh wounds caused by removal of the bark are at once covered over with moss, strips of bark rich in quinine can be repeatedly taken from the same trees without injury to their vitality, so that the *C. succirubra* of India and Ceylon will command as high a price as the *Calisaya* of Bolivia, at present the most valuable, and worth, in the English market, one dollar per pound. At twenty-five cents per pound the cultivation would be profitable to the planter. From the analysis made by Mr. Howard, of London, it would appear that the effects of cultivation have not led to any diminution of the amount of valuable alkaloid obtainable from the cinchona.

Mr. Markham forwarded seeds to two West India islands, Trinidad and Jamaica. Those sent to Trinidad did not succeed—in fact, did not germinate; while, on the other hand, the first seeds of the cinchona which were received at the botanic garden at Bath, in Jamaica, in the autumn of 1860, were taken charge of by Mr. Wilson, then superintendent, who, in twelve months, had 400 healthy plants raised, although there was some misfortune in selecting a place, which, as summer advanced, was too warm. When removed to a coffee plantation 4,000 feet in elevation, they immediately grew vigorously, so that in November, 1862, plants of the *C. succirubra* variety were 44 inches high, with leaves 13½ inches long by 8¾ inches broad. In December, 1863, when two years old, they were 6 feet high, with 10 branches, and a stem 4½ inches round at the base. The gray bark *Cinchona nitida* and *C. micrantha*, being slow growers, are less in height by one foot. From some cause it became necessary to remove the plants down to Bath, when they all commenced to fail, and would have died had they not been temporarily removed to a neighboring elevation, Mount Essex, somewhat over 2,000 feet in altitude. Here they have struggled against want of altitude and too stiff a soil. The experiment in Jamaica, up to the spring of 1864, has shown that the mountain districts of that island are well suited for the cinchona plants, and also shows the necessity of planting the trees at the most elevated locality, in which the mean temperature of the year is favorable to their development.

The success thus recorded of the plantation at Sikhim and Jamaica is very encouraging, since these stations are far removed in latitude and absolute elevation from the natural habitat of the cinchona. Indeed, the luxuriance of growth in these stations, and the experiments of Mr. McIvor and Dr. Anderson at the plantations on the Neilgherry mountains and in the country north of Calcutta, have shown that the cinchona species will flourish at the very verge of the tropics; and, as its vitality appears as great at Jamaica as in its native hills in

Peru, it is fair to suppose that if we obtain an equable climate and a sufficient rainfall within the limits of the United States it will flourish here also.

As any station in the United States would necessarily be outside of the tropics, and not able to command the annual rainfall of 100 inches which it receives both in Bolivia and the East Indies, it would be desirable to make the selection of seeds and plants from those points where latitude, climate, mean temperature, and elevation would most nearly resemble that to be found in our Pacific sierra. New Granada or Jamaica, as already stated, would probably furnish plants which would more successfully thrive than by selecting seeds and plants wholly from an equatorial latitude.

The growth of cinchona at present in existence, outside of South America, may be thus set down:

1. Dutch plantation in Java, established in 1854.
2. English plantation on Neilgherry hills, in Malabar, coast of Hindoostan, established February, 1860.
3. English plantation at botanic garden, near Peredenia, in Ceylon, established February, 1861.
4. English plantation at Darjhieling and Runghee, near Calcutta, established June, 1862.
5. English plantation at Mount Essex, Jamaica.
6. Propagating beds in Kew Garden.
7. Lesser plantations at the Mauritius, Queensland, Natal, and Trinidad.

Thus it will be seen that, with the exception of the Dutch plantation, Great Britain is the only nation which has taken a step in the direction of preserving and propagating the cinchona trees. We have seen a statement in the daily papers (without official sanction) that "the Mexican government has very recently taken steps to establish cinchona plantations within its limits, and took advantage of Mr. Cross's expedition in 1866, from Chimborazo to Pasta, through the bark district, to secure some of the seeds which he had collected."

The only real efforts which have been made in the direction of securing to this country a supply of these plants have been made by Hon. C. R. Buckalew, United States senator, who, while minister resident at Ecuador from 1858 to 1861, was fully alive to the importance of securing new forests of cinchona outside of South America, and who devoted much time and attention to securing seeds of the best species, in order to obtain plants of home growth which might probably bear the climate of the United States. Being a gentleman of taste and well versed in botanical science, success was more likely to follow his exertions. He had there made the acquaintance of Mr. R. Spruce, the able English botanist, who had spent many years in travel and was already familiar with the *flora* of the Andes, and had published many valuable contributions to the natural history of that important region; also that of Mr. Cross, Dr. Jamieson, of Quito, Dr. James Taylor of Riobamba, and other influential parties in Ecuador, the result of which was his being able to obtain seeds of all the most valuable species which grow in that State—no small matter when it is recollected that a heavy fine is annexed to the act of sending any seeds or plants of cinchona out of that State. Mr. Buckalew describes the *Cinchona succirubra*, or red bark, the *Cascarilla roja* of the natives, as found on the western declivities of the Ecuador Andes at 3,500 feet elevation, west of Chimborazo, in dense forests, where the rainy and dry seasons alternate. The former occurring from February to May inclusive; the latter from June to October. Light and frequent rains during the dry season. The latitude is from 1½° to 2° south. This species is not found elsewhere, and it is the most valuable of all the cinchona species, except one in Bolivia, which competes with it in merit. Seeds of this species were secured by Mr. Buckalew, through Dr. James Taylor, in the year 1864, from which the plants in the agricultural garden were produced. Through Mr. Buckalew's exertions the present Commissioner of Agriculture was induced

to take some steps, "in order to propagate in this country the *Cinchona succirubra*, indigenous to Ecuador, in particular; and perhaps, also, the *Cinchona lancifolia*, of southern New Granada; also, a species from Jonbabuon, northern Ecuador."—(Letter of Commissioner Newton, April 23, 1864.)

Mr. Buckalew describes the *C. condaminea* as growing in southern Ecuador, in the vicinity of Loxa, on the eastern slopes of one of the chains of the Andes, which reach northerly to Cuencas, where there had been a factory for obtaining the alkaloids from this species. The area of growth of this species is very considerable, and it bears cold better than the *C. succirubra*, but he states that it requires more careful manipulation to domesticate it near a sea level, on account of the great change in atmospheric pressure and summer temperature to which it would be subjected.

In 1864 Dr. Jamieson forwarded to Mr. Buckalew some seeds of a species of cinchona found in southern New Granada near Pasto, in a region of forests, which package was forwarded to Washington, but the seeds failed to germinate here. Some seeds of the same species which were forwarded to India also failed—perhaps imperfect seeds or badly preserved. The tree itself has been spoken highly of by Mr. Cross, who found it growing on the slopes north of the volcano Purare in the central Cordillera of New Granada. It furnishes the Pitaya bark, and belongs to *C. condaminea*. Mr. Cross thinks this the most valuable species of tree for transplantation, since the bark grows very rapidly. In his most recent travels in the Andes he found this cinchona at Pitaya only on dry slopes and never on cool grounds, with a temperature varying between two ranges, thus: Lower limit—day up to 59° to 60°; night, 46° to 48°. Upper limit—day up to 40° to 48°; night, 35° to 36°. At the lower limit the night temperature at times ran down to freezing. Mr. Buckalew states also that it can bear occasional frosts better than any other species, and Prof. Jamieson, of Quito, analyzed the bark and found it to contain 3.2 per cent. of quinine when six years old; large trees yield 4 per cent., and the roots yield 5 per cent. This bark goes chiefly to France, and this is the region where the trees are so recklessly destroyed. For these several reasons, rapid growth, abundance of alkaloid, and capability of bearing colder climate, this species (Pitaya) would seem to be that which it would be most desirable to secure for trial growth within the United States. In New Granada and Colombia it is more esteemed than any Peruvian bark. Having a habitat further north and upon elevated mountains it would appear likely to bear transplantation and suffer less from acclimatization than other varieties or other species.

The opinion of one who, like Senator Buckalew, has made himself acquainted with the species in their native habitat, should carry much weight with it; while he recommends the cultivation of both *C. succirubra* and *C. condaminea*, he considers that the attempt, especially with the latter variety, will require great care and attention, since a rapid change of climate by hasty transplanting will only result in failure. On this account the Pitaya variety deserves attention.

Of the seeds of the *C. succirubra*, *C. condaminea*, and the species found near Pasto, New Granada, (Pitaya,) forwarded by our minister, only the second named germinated. Mr. William Saunders, superintendent of the propagating garden of the Department of Agriculture, in a letter to Mr. Buckalew, dated July 13, 1865, describes the *Cinchona condaminea* plants as flourishing and looking very well. Since then it has been found difficult to raise them under conditions so very different from that to which the species is subject. The proximity to sea level and the vicissitudes of climate in this district render it almost impossible to keep the plants healthy. As regards the soil, when selecting a locality for a plantation, it should be borne in mind that the cinchonas need a rich, fresh land, a fine chocolate loam from two to three feet deep, with an open subsoil and slight slope in the beds to allow of drainage—stagnant water about the roots being very prejudicial to growth. The growing plants are tender and need a site sheltered

from the prevalent strong winds, which may break or injure the limbs or twist the plants. In the northern hemisphere a northwesterly aspect, being a moist one, is preferable; a certain temperature is desirable, which ought not to descend below 50° Fahrenheit, nor have a range greater than 20°, an equable climate in every sense; a moderate amount of rain in showers, not less than fifty inches, if possible, nor yet too much, for excess of rain or drought is injurious. The rain should fall at the proper season; in the season of wood growth, they need an abundant supply of moisture, and in the time of ripening the capsules, dry weather and clear sunshine are equally needed.

Wherever these conditions are attainable a cinchona plantation may be formed; and then, the greater the elevation above sea level the more successful will be the growth and thicker the bark. At high altitudes the occurrence of night frosts after warm days is to be avoided. Hence it is that the trees will not flourish in Ceylon, above 5,000 feet, while on the Neilgherry mountains they succeed from 4,500 to 6,750 feet above sea level.

A few botanists have expressed a belief that the climate of Texas is suitable for cinchona cultivation. Dr. J. M. Bigelow, of Detroit, considers western Texas and Arizona as a fitting region for the experiment. Mr. R. Spruce, in a letter to Mr. Buckalew some years since, expressed a belief that Texas or Cuba would furnish a suitable climate. Personal experience of Texas leads me to hold a very different opinion. The rain-fall of western Texas and eastern Arizona does not exceed twelve inches per annum, and the reduction of temperature in winter is considerable and very sudden. On these accounts I would by no means recommend trials in these districts, not, indeed, anywhere in the United States outside of California. I would recommend the experiment of a plantation in that State at some distance from the coast between San Luis Obispo and San Diego counties. A tolerable acquaintance with California climate enables me to state that such a district would be suitable.

The following statement of mean temperature of the district at the base of the Sierra Nevada from 40° to 32° north latitude, will serve to contrast that locality with the stations in the East Indies: Spring, 55° to 65°—range, 10°; summer, 70° to 80°—range, 10°; autumn, 60° to 70°—range, 10°; winter, 45° to 52°—range 7°. Yearly mean range from 45° to 80°.

The rain-fall during the same seasons was—

Spring	10 cubic inches.
Summer	2 cubic inches.
Autumn	3 cubic inches.
Winter	10 cubic inches.
Total for the year	35 cubic inches.

Higher up the slopes of the range of course the temperature would be lower, and the rain-fall greater; hence it would not be difficult to select there a station which would combine the necessary moisture and warmth. The equability which exists below we have no reason to suppose would be altered above, and this is the chief condition favorable to the growth of the trees.

Indeed, there is the most remarkable equability of climate along the mountain ranges of California from San Diego to San Francisco. The line of equal temperature runs along the Sierra Nevada; and at San Diego, for six years, the temperatures for January differ only 3° 6′, and for December 4° 8′; at San Francisco, 5° 5′ and 6° 6′ for similar months; at Benicia, 6° 9′ for January and 3° 5′ for December, for the same period of years. The sea breezes temper the summer of the country south of Monterey, while in Los Angeles and San Bernardino counties the proximity of the high mountain chain reduces the temperature of winter to that of the country north of San Francisco. Upon San Bernardino mountain the snows of winter remain for some months, and a temper-

ature near to the freezing point at times might be obtained on the elevated plains at the foot of Kikal Mungo and San Bernardino mountains.

These temperatures may be contrasted with those on the Neilgherries. Ootacamund is in the centre of a plateau, by no means a flat surface. The rains come in the southwest monsoon from May to September from the west, and at other times it receives the rain of the northeast monsoon. The total rain-fall is from sixty-five to seventy inches. The mean temperatures range from 42° to 58°. At a station lower down on the range, (Coonoor,) the mean range is from 52° to 71°. Any where between 34° and 37° in the western slopes of the Sierra Nevada a temperature similar to that of India may be obtained by ascending the range to from 1,500 to 2,000 feet above its base.

Three feet of rain yearly is sufficient for the tree if it gains what is necessary during the early period of growth. It does not need rain, but sunshine, while flowering and fruiting.

The Sierra Nevada region is remarkable for the great excess of heat for the altitude of the region. An inspection of the charts of Blodgett shows that the isotherms continue running in a uniform direction, not across, but along the whole region for several degrees of latitude. On the western slopes of these ranges the heat is intense as you emerge from the valleys, but as the ascent is continued cooler air prevails, and at elevations below the point where ice forms during many months of the year a temperature suitable could doubtless be found. These observations apply to that portion of the Sierra south of San Francisco, or even of Monterey, and preferably at a parallel extended from Point Conception to within thirty miles of San Diego. A personal experience and examination of the southern counties of California, I think, justify the assertion that on the western slopes of the Sierra Nevada, in Tulare county, or on the mountain ranges in Santa Barbara county, may be found all the essentials of climate needed for the vigorous growth of the cinchona. Dr. Thomas M. Logan, of Sacramento, California, in his paper on the "Medical Topography and Epidemics of California," published in the Transactions of the American Medical Association, 1865, states that below Meno lake and the headwaters of the San Joaquin the forest trees creep up the sides of the Sierra to a height unexampled in other Alpine situations—as far as 11,000 feet.

Dr. Logan also refers to an account of Professor Brewer's geological explorations, as showing that good pasturage reaches from 5,000 to 10,000 feet above sea level, and even higher, up to the very crests of the peaks. On the east slope, at 3,500 feet above sea level, the dense forests begin, commencing with the sugar and yellow pine, the Douglas spruce, fir, and bastard cedar. On the west, at an altitude of 5,000 to 7,000 feet, the "big trees" or the giant sequoias are abundant, "not merely occurring," Dr. Logan says, "in isolated groves, but scattered abundantly in common with the timber for a distance of at least twenty-five miles along the tributaries of Kings, Kaeveah, and Kern rivers. Larger trees are met here than in the celebrated Calaveras and Mariposa groves. The largest reported is almost forty feet in its greatest diameter."

Immediately below this *sequoia* region in altitude, I believe, could be found all the conditions of climate which would support the cinchona. This portion of California has a climate peculiar to itself; possessing a mountain range eighty miles deep, and cut up into vast chasms or cañons; having streams constantly flowing, and having an altitude over 15,000 feet for many miles, constituting the highest mountain range in our territory, of which the noble mountain of San Bernardino is the southwestern outline; having snow for many weeks of the year on their summits, they are not subject to that intense aridity of climate which is the general characteristic of California, while they do possess that other peculiarity of the Pacific States, namely, a greater equability of temperature through the year. The thermometer registry of San Diego, at the southern foot of this range, shows this equability of climate exceedingly well. Its altitude is only 150 feet

above sea level, and through an average of six years it gives the following ranges:

Hottest mean day, 74°; coldest mean day, 52°; range, 22°.

Mean temperature of year, 62°.

Fall of rain and snow, 10 inches.

As the sierra 40 miles north of San Diego is much more elevated than at that parallel, it is much better watered; and as the snows remain during winter, its supply is more equally distributed. I do not consider San Diego as a suitable point, but give its temperatures, as it has been an army post and recorded faithfully for many years. As the latitude increases along the coast, the difference between summer and winter temperature diminishes, so that at Monterey, in latitude 36° 36′ N., by observations of six years—

Hottest mean day, 59°; coldest mean day, 50°; range, 9°.

Mean temperature of year, 55°.

Fall of rain and snow, 12.20 inches.

A critical and discriminating inquiry for the most appropriate district for establishing an American plantation will, I am fully convinced, result in the selection of the Pacific coast, as near to the Mexican frontier as a suitable elevation can be obtained.

Scarcely seven years have passed since the first plants were introduced into India, and there are now nearly a million and three-quarters of trees scattered over the hill ranges of Ceylon and India, from Hakgalle to the Himalayas of Bengal, flourishing everywhere, except in those secluded hollows where the night-frosts kill them.

The oldest plants set out in August, 1862, were, at Markham's last visit to the Neilgherry at the close of 1865, from 8 to 12 feet high, and from 7 to 13 inches in girth, at 6 inches from the ground, well furnished with lateral branches, and in every respect quite healthy. Planted 10 to 12 feet apart, the branches of the neighboring trees touch, the bark is of considerable thickness, and the lichens and mosses being fully developed, the characteristic markings of the best barks are becoming apparent.

In view of what has been accomplished in India, the government of Madras is entitled to great credit for practically working out Dr. Royle's suggestion, and demonstrating that there are climates elsewhere than in the Andes which are suitable for growing the cinchona. A great step has been made in the right direction by this act alone. Whether with the growth there is present the full amount of alkaloid or not, cannot, perhaps, at once, be ascertained. The cinchona may, by transplanting, vary in its relative richness of quinine; but that it does already furnish sufficient to pay expenses of cultivation, and thus secure a supply of this most valuable drug, even at its present high rate, is abundantly evident from the preceding, for it must be remembered that the cinchonas can scarcely be said to be cultivated in South America. Under a continual increasing demand for bark they will inevitably disappear, and the question to be solved really is, not whether the price of quinine can be kept down by additional growth of trees, but whether it can be supplied at any price. If India can show, as she promises speedily to do, that she can supply her own demand, it is surely time for the American government to take steps to introduce the plantation of cinchonas into the United States, where there is little doubt that there are territorial and meteorological conditions equally, if not more suitable for the cultivation, and more nearly resembling the Andean conditions than any place in Hindoostan.

That the government should take this subject of acclimatization into serious consideration is manifest when we consider what will be the fate of the trees in South America; without cultivation and by constant destruction they must rapidly decrease, and ultimately disappear. The *loxa*, or brown bark, may be taken as the type indicative of the fate of the rest. It (*Cinchona officinalis*) is

now nearly extinct upon its native hills, and if it is to be again introduced extensively into commerce it must be from the Neilgherry plantations.

There are now comparatively few difficulties standing in the way of a successful result to such a noble enterprise as the establishment of a cinchona plantation within our own territory. Attempts have been so frequently made, that the difficulties are known beforehand and the remedy provided. The packing and transplanting may be made with comparative freedom from losses by the use of the improved wardian cases. The chief difficulty with the original wardian cases arose from their being too heavy, when planted and packed in the ordinary way, the weight of the earth, and the small number of the plants which could be accommodated. Mr. McIvor reduced the weight of the cases to one-fifth, by filling them with moss instead of earth to the depth of six inches, and the plants, in pots, are firmly fixed in the moss, secured with cross-battens, so as to prevent injury from upsetting. A moderate amount of water is supplied, the sashes screwed on, the glass of which is protected by battens, and secured by thin cloth strip from excessive sun, while admitting some light. In these, plants can be safely transported considerable distances.

Our relations with the South American states are sufficiently friendly to render successful official negotiations for obtaining plants; but should any difficulty arise in that quarter leading to jealous refusal, then a request could be made to the English government for a supply of young plants from Jamaica, or some of their other stations, and such arrangement could meet with no objection; for since the English government established their plantations in India, not for the sake of commerce nor of government monopoly, but simply to supply that large colony with an article so needful to health, in its malarious climate, as quinine has become, then the same spirit of humanity which laid a foundation for a supply would liberally co-operate in its extension to ague-producing countries

SHIP TIMBER IN THE UNITED STATES.

BY WILLIAM W. BATES, CHICAGO, ILLINOIS.

TIMBER adapted to the purposes of ship-building is found in great abundance and variety in most of the States of the Union. It would be singular, indeed, were this not the case in a region of the globe which produces one hundred and forty kinds of trees, and is not less remarkable for the number than the extent of its navigable waters. In the forests of the United States at least thirty varieties of woods may be found which are suitable for the construction of vessels, boats, and barges, for ocean and inland navigation; but perhaps not more than twenty are yet in common use.

THE PROPERTIES OF SHIP TIMBER.

The properties of wood required in ship timber depend much upon the place, purpose, and use of the several pieces composing a ship; hence, as woods differ greatly in their properties, some kinds are far more generally useful than others, although it may occur that the wood of limited utility proves indispensable in building, on account of its peculiar fitness for certain parts of the work. In the structure of a ship, timber is subjected to many strains and deteriorating influences not found in other combinations of wood-work. The properties in

demand are, therefore, more numerous and peculiar in ship carpentry than in any other branch of the arts. They may be defined as follows:

1. Strength—in the resistance of strains, tensile, crosswise, and compressive.
2. Solidity—in the hardness of the wood and compactness of fibre.
3. Stiffness—in rigidity of fibre, elasticity, cohesion of grain.
4. Lightness—in bulk of substance.
5. Flexibility—in bending to the forms required by the builder.
6. Toughness—in resisting penetration and cleavage and concussion.
7. Durability—in resisting fermentation, decomposition and rot.
8. Tenacity—in holding metal fastenings, bolts, spikes, or nails.

As all trees during growth are influenced by soil, climate, and culture, it is natural that timber from different parts of the country should vary in degree, as they do in the possession of these properties; hence it is that ship timber is valued in market according to the place of its growth, that produced within sixty miles of salt water being generally accepted as the best. It is also to be observed that the timber of all hard-wood trees is greatly improved by being grown under exposure to the sun and air; and that the timber of northern growth will not endure so long in ships sailing in southern seas, as the timber of southern growth will in vessels navigating either northern or southern waters. Timber for ships or boats should, therefore, be selected with reference to place and mode of growth, as well as regard to suitable kinds of wood; and in certain cases it would be proper to consider the range of latitude of the voyages intended to be made.

KINDS OF SHIP TIMBER USED IN THE UNITED STATES.

In the navy yards fourteen kinds of timber are used for various purposes, viz:

1. Live oak—in frames, keelsons, keels, beams, knees, &c.
2. White oak—in keels, keelsons, frames, rudders, stern-posts, planking, ceiling, beams, knees, stems, planksheers, rails, &c.
3. Yellow pine—in beams, deck framing, ceiling, planking decks, masts, spars, &c.
4. White pine—in decks, finishing lumber, masts, bowsprits, &c.
5. Black spruce—for small spars, poles, &c.
6. Red cedar—in tops of frames, &c.
7. Yellow locust—for tops of frames, stanchions, bits, &c.
8. White ash—for blocks, tops, oars, &c.
9. Hickory—for capstan bars, handspikes, &c.
10. Black walnut—for finishing and ornamental purposes, chiefly.
11. Hackmatack—for knees only.
12. Mahogany—for hatch coamings, finishing, &c.
13. Elm—for gun-carriage timber, chiefly.
14. Cypress—sometimes used for decks, bulwarks, &c.

On the Atlantic coast merchant ship-builders use several additional kinds of timber. These are denominated mixed woods. The American Lloyds',* of New York, have classed timber for use in various parts of vessels, as follows:

First class, or standard.

1. Live oak—in frames, keelsons, keels, beams, knees, or other parts.
2. White oak—in frames, planking, ceiling, beams, knees, breast hooks, or other parts.

* The American Lloyds' inspect and classify shipping for the information of underwriters. Their rules are based on the practice of ship-builders and the experience of their surveyors. The classification of vessels depends upon the model, general proportions, materials used, mode of construction, sparring, and outfitting.

3. Locust—in top-timbers, treenails, bits, &c.
4. Red cedar—in top-timbers, stanchions, &c.
5. Hackmatack—in top-timbers, deck frames, and knees.
6. White-heart chestnut—in top-timbers.
7. White pine—in deck plank, masts, bowsprits, bulwarks, and cabin.
8. Yellow pine—in deck frames and deck, masts and spars, clamps, stringers, ceiling, waterways, and rails.
9. Pitch pine—for same uses as yellow pine.
10. Black spruce—for small spars.

Mixed woods.

11. Oak, black or yellow—in frames or planking.
12. Hard maple—in keels or plank of bottom.
13. Hickory—in keels or other parts of bottom.
14. Beech, red and white—in frames, planking, or other parts.
15. Birch, black or yellow—in keels, floors, or other parts.
16. Rock elm—in frame, planking, keels, &c.
17. White ash—in top-timbers, rails, oars, &c.
18. Red pine—in top-timbers, ceiling, deck frames, decks, masts and spars.
19. Bald cypress—in deck-plank, bulwarks, &c.
20. Sweet gum—in keels, frames, beams, &c.

Vessels constructed in whole or part of mixed woods, so called, cannot be assigned to the first class at the American Lloyds'; nevertheless, some of the sorts of wood in the class of mixed are just as good as any for the construction of the smaller sizes of vessels. It is highly probable, too, that many of these woods, if properly operated on by chemical agencies for the preservation of their timber properties, would be found eligible for admission to the first or standard class. At least ten other kinds of wood might be named for a place among the mixed woods, though seldom or never used in ship-building.

On the northern lakes fewer kinds of timber are in use. The lake underwriters' rules classify for timber and plank as follows:

First class, in various parts of vessels.

White oak, hickory, hard maple—keels.
White oak, tamarack, red cedar—top-timbers.
White oak—in transom and knightheads, stem and stern-posts, keelson and centre box.
White oak, tamarack, red or yellow pine—beams.
White oak, tamarack—breast hooks and knees.
White oak, hard maple—in plank from keel to light water-mark.
White oak—plank from light water-mark to gunwale, planksheer, and rail.
White oak, tamarack—ceiling of floor.
White oak—bilge strakes, clamps, shelf.
White oak, tamarack—ceiling, clamps to bilge.
White pine, red pine—deck plank, masts and spars, bulwarks, bulkheads, finishing lumber.

Other woods are but little used. Pine roots are sometimes got for breast hooks and knees; black walnut and white wood have been used for deck plank; beech, birch, maple, and elm were once considered good for frames; and vessels have been built principally of elm. Several varieties of oak pass inspection as white oak. Occasionally, chestnut and locust have been used for top-timbers.

On the western rivers the woods in use in boat-building are few indeed. The principal kinds are white oak, white pine, and poplar; the hulls throughout are of oak; deck plank of pine, or cypress occasionally; framework of cabins of

poplar; joiner work of cabins of white pine or poplar, the latter being preferred; and the stanchions and bulkheads of hold are of red cedar or pine.

On the Gulf coast few vessels are ever built. The principal timber used is live oak, white oak, red cedar, and mahogany, in frames; pitch pine and white oak planking; pitch pine deck frames and ceiling; locust, red cedar, and mahogany rail stanchions; yellow pine, cypress, or white pine decks and bulwarks; and yellow pine for masts and spars. Louisiana and Texas produce live oak of the best quality in abundance, and also other woods which would be found useful in ship-building.

On the Pacific coast ship timber has a limited range in respect of variety; nevertheless, it has been stated, on the authority of the naval constructor at Mare Island navy yard, that California and Oregon have in themselves all the different kinds of timber necessary for ship-building. He found, near Petaluma, superior trees of the live oak species, some of which have been cut and used. Vessels have been built with frames of pepper wood, which is quite hard, and said to be durable. Oregon produces an abundance of red and white pines for the supply of the entire west coast; and vessels have been constructed entirely from the denser sorts of pine timber, both in Oregon and California. White oak timber, in small quantities, is exported from New York and Boston to San Francisco, for repairing ships.

DESCRIPTION OF SHIP TIMBER FOR THE VARIOUS PARTS OF A VESSEL.

1. *White oak* is the most useful timber known in ship-building. On the northern lakes and western rivers we have seen that the hulls of vessels and boats are almost entirely built with it. The several varieties of oak which are used would be best distinguished by the forms of the *leaves;* but these are not brought into the ship-yards; and as the bark, which is brought in abundantly, and the wood color of several trees of the oak family seem to interchange appearances with the varying changes of soil and climate, ranging over many degrees of latitude and longitude, it is the practice of timber getters to make *white oak* timber of other varieties, which are, no doubt, somewhat inferior in important properties.

White oak is found in nearly all the timbered States of the Union, but abounds most in the middle and northwestern States. Its wood excels in the properties of strength, flexibility, toughness, durability, and tenacity. For the frames, longitudinal timbers, and planking of vessels, particularly below water, and for knees, this timber is regarded as superior to every other kind. For various parts above the water it is not so highly appreciated, on account of its liability to immoderate shrinkage—about three-eighths of an inch in the foot—and because exposure to the weather impairs its durability. The wood of young trees—sixty to one hundred years of age—is much tougher than that of old ones, particularly of those growing on high lands, which become brittle after they have ceased growing. These old, brittle trees, when used in building vessels, are generally cut into short lengths to facilitate hauling, and taken to the mills, and there sawed into *flitch timber* for the frames. The most crooked timbers are easily obtained from these wide flitches; hence, the poorest timber of an oak forest not unfrequently goes into those parts of a vessel which naturally require the strongest and most durable timber.

No certain data exists for comparing the properties of white oak grown in various districts of the timber-producing regions of the United States; but it is generally supposed that the timber grown within sixty miles of the seaboard, and within a lesser distance of the American shore of the great lakes, is the best, especially for durability. It may be noticed here, that there is a difference in the soils of the coast and inland districts, which becomes manifest in the ashes of the oaks of the respective regions. The *potashes* of commerce are obtained in considerable

amount from inland oaks; if we attempt to wash the ashes of those grown on the sea-coast, we find *soda* chiefly, because, the salt being at hand, they are abundantly supplied with that base. But as the salts of potash and soda are isomorphous bodies, acting as substitutes for one another, it remains for other tests to discover which region produces the best timber.

If *density* be taken for a criterion, certain it is that much of the oak of the interior of the country is just as rich in valuable properties as that grown on the sea-coast. We have seen the growth of broad acres of oak, of such specific gravity that it could not be floated to the mills without great difficulty; and was, on this account, given to the flames, to clear the land.

The worms and worm-holes found in white oak frequently constitute inadmissible defects, spoiling it for ship timber. These holes, made in the living tree, often contain the worms alive; in which case, they will be found not to cease working in the wood until the termination of their career. Such timber is unfit for planking, on account of the impossibility of stopping all the holes, and because the *bite* of the worm impairs the durability of the bitten part. Heart shakes and limb rots, are also common defects in white oak timber; and the degree to which large logs will sun-check, if not protected from the weather in seasoning, will spoil them for first-class uses in one or two years.

The results of experiments show that the least water is evaporated from squared oak timber cut in the months of February, March, April, and May. One piece, cut in May, lost twenty-three per cent., and another, cut in August, lost thirty-three per cent., in *four* years.

If the year be divided into *two seasons*, thermometrically, and the cool season, or winter, be reckoned from October to March, inclusive, and the warm season, or summer, be taken from April to September, inclusive, it will appear, first, that there is ten per cent. in one year, and five per cent. in four years, more shrinkage in weight of the squared timber which is cut in the *warm* season than in that cut in the cool season; second, that in the case of round logs in bark, there is eight per cent. in one year, and seventeen per cent. in four years, more loss by evaporation, if cut in the *summer* season.

This knowledge is important, not only in pointing out the influence of summer and winter upon cutting white oak, but as explaining the interesting fact, that the season of cutting makes far more difference with the condition of the *sap*-wood than with the heart-wood of the tree. In the coldest months of the year, when the tree is shrunk and the sap frozen, a superabundance of circulating juices is not present in the heart-wood; whereas, in the hottest months—July and August—the wood of the tree is expanded to its largest dimensions, the vital forces are most vigorously at work, and consequently more fluid ascends the capillaries of both the heart and the sap-wood. This principle will be found to govern the timber productions of nearly all trees in the temperate zone.

Mean specific gravity, weight, and shrinkage of green North Carolina white oak, cut in each month of the year.

	Spec. grav.	Pounds.	Ounces.
Twelve pieces of squared, 3 feet lengths..........	1.069 =	66	13
Twelve pieces of round in bark, 3 feet lengths.....	1.020 =	63	12

Shrinkage in seasoning one year.

Loss of weight in summer cut logs, in bark	18 per cent.
Loss of weight in winter cut logs, in bark....................	16 per cent.
Difference in favor of winter cut logs	2 per cent.
Loss of weight in summer cut squared timber....................	21 per cent.
Loss of weight in winter cut squared timber....................	19 per cent.
Difference in favor of winter cut timber....................	2 per cent.

Shrinkage in seasoning four years.

Loss of weight in summer cut logs, in bark	32 per cent.
Loss of weight in winter cut logs, in bark	26 per cent.
Difference in favor of winter cut logs	6 per cent.
Loss of weight in summer cut squared timber	27 per cent.
Loss of weight in winter cut squared timber	26 per cent.
Difference in favor of winter cut timber	1 per cent.

2. *Live oak* may be placed second in the catalogue of ship-timber trees in the United States. It is so called on account of being an evergreen oak; and is found only in the southern States lying on the Atlantic and Gulf of Mexico, and sparsely near the coast in California. The trunk is seldom straight or tall, though it attains a growth of twelve feet in circumference in its native hommock. No forest tree on the continent is more remarkable for the number and magnitude of its branches; hence its singular adaptation for furnishing crooked timber and knees for the frames of vessels. It combines all the properties required for frame timbers in remarkable degree; and excels especially in those of strength and durability. The capillary vessels of the heart wood are filled with a gummy or glutinous substance; and, unlike other varieties of oak in this country, it is free from astringent acid.

Live oak is not adapted to the reception of spike fastening, as the grain will not admit the point in the cutting direction, but will invariably turn it, and cause splitting of the wood. There is no difficulty, however, in using bolt and tree-nail fastening. The *sap* wood is whitish in color, and free from the glutinous substance found in the denser heart wood, which is, in consequence, of greater durability; but the sap wood is, nevertheless, generally deemed good enough for use, except in the navy. Live oak is liable to have large heart shakes; and if exposed long to the open air, in the rays of the sun, or the shrinking blast of winter winds, it will check badly. It does not require many month's seasoning, however, to fit it for its ordinary uses in vessels.

Except on account of the sap wood, through the capillaries of which the fluids of live oak trees almost exclusively ascend, it will be seen that it makes little or no difference, on account of the shrinkage, when the timber is cut. It is now the most costly in market.

Mean specific gravity, weight, and shrinkage of green North Carolina live oak, cut in each month of the year.

	Spec. grav.	Pounds.	Ounces.
Twelve pieces of squared, 3 feet lengths	1.259 =	78	11
Twelve pieces of round, in bark, 3 feet lengths	1.191 =	74	7

Shrinkage in seasoning one year.

Loss of weight in summer cut logs, in bark	5 per cent.
Loss of weight in winter cut logs, in bark	6 per cent.
Difference in favor of summer cut logs	1 per cent.
Loss of weight in summer cut squared timber	5 per cent.
Loss of weight in winter cut squared timber	5 per cent.
Difference in favor of either season	None.

Shrinkage in seasoning four years.

Loss of weight in summer cut logs, in bark	23 per cent.
Loss of weight in winter cut logs, in bark	27 per cent.
Difference in favor of summer cut logs	4 per cent.
Loss of weight in summer cut squared timber	23 per cent.
Loss of weight in winter cut squared timber	22 per cent.
Difference in favor of winter cut timber	1 per cent.

3. *Yellow* or *long-leaved pine* occupies the third place, in order of importance, as suitable for use in certain parts of vessels. It is very commonly confused in name with *pitch pine;* and both species, in New England, are denominated *hard pine*. They are both extensively used, by Atlantic ship-builders, for planking, ceiling, stringers, beams, waterways, rails, keelsons, &c., but seldom for any part of the frames.

The yellow pine sometimes attains a height of one hundred and fifty feet and a diameter of four feet, but the pitch pine seldom exceeds two-thirds of this altitude and size. The former is principally grown in the States of Virginia and North Carolina, while the latter abounds in all the Atlantic States south of Chesapeake bay. The yellow pine required in the navy-yards is described as long-leaf, fine-grained, southern yellow pine. Pitch pine is never called for: the wood being coarser in the fibre and grain, and the capillary vessels surcharged with turpentine, it is neither so strong nor so flexible, while exceeding in weight the favorite variety.

By some persons density has been regarded as the index of durability. It is a fact, however, that the sap wood of yellow and pitch pine is the least durable portion of the wood, notwithstanding its density is far greater than that of the heart wood. Indeed, the sap-wood of these pines seems to be only a vegetable sponge absorbing and retaining moisture, having in very moderate degree the proper wood qualities required in timber, and wanting almost entirely in that of durability. It is proved by experience in using yellow and pitch pines that the best timber for strength and durability is not that of the greatest density, necessarily, but rather it is that in which the even fineness of the grain is continued to the pith of the tree, and that the wood of greatest weight is so because of a superabundance of turpentine in its vessels.

Though not so tough as white oak nor so flexible, yet the yellow pine successfully rivals it in stiffness. If two beams of each wood, of equal dimensions, be suspended by the ends, the oak beam will depart further from its mould than the pine, and will break under about the same weight. In dry situations it is extremely durable, and where a lighter yet solid wood is required it is preferred to oak of whatever kind.

Mean specific gravity, weight, and shrinkage of green North Carolina yellow pine cut in each month of the year.

	Sp. grav.		Pounds.	Ounces.
Twelve pieces of squared, 3 feet lengths............	.637	=	39	13
Twelve pieces of round, in bark, 3 feet lengths.......	.781	=	48	13

Shrinkage in seasoning one year.

Loss of weight in summer cut logs, in bark....................	16	per cent.
Loss of weight in winter cut logs, in bark.....................	19	"
Difference in favor of summer cut logs........................	3	"
Loss of weight in summer cut squared timber..................	11	"
Loss of weight in winter cut squared timber...................	14	"
Difference in favor of summer cut timber......................	3	"

Shrinkage in seasoning four years.

Loss of weight in summer cut logs, in bark....................	27	per cent.
Loss of weight in winter cut logs, in bark.....................	31	"
Difference in favor of summer cut logs........................	4	"
Loss of weight in summer cut squared timber..................	13	"
Loss of weight in winter cut squared timber...................	16	"
Difference in favor of summer cut timber......................	3	"

Differing from white oak, it is here shown that yellow pine should be cut for timber in the summer season, especially such sticks as are to be kept in the round state until used, as masts and spars, and from these the bark should be taken when cut, that the sap-wood may season before fermentation of its juices takes place and rotting begins. The heart-wood requires only a few months' seasoning for the ship-builder's use.

4. *White* or *northern pine* is found at the head of the list of the softer woods used in building vessels of every description. It grows more or less abundantly in every northern State of the Union from Maine to Minnesota, often reaching an altitude of one hundred and eighty feet, with a diameter of six or more. It is principally used for deck plank, water-ways, bulwarks, cabins, masts, and spars. In the construction of river steamboats white pine is invaluable, and is sometimes used in almost every part of the boat, except the frame, above light water mark. This is on account of its exceeding lightness, strength, and durability. No wood is better adapted to withstand the sun and weather, for with proper seasoning and reasonable protection after the work is finished it retains its properties as long as the best kind of oak. We have seen, however, that poplar has for some years past been substituted for pine in building the cabins of boats on the Ohio and Mississippi rivers, so that this favorite wood is not without a rival in steamboat joinery.

There are many varieties of the white pine; the lightest and the heaviest woods differing in density at least twenty per cent. The average weight of a cubic foot of seasoned New England white pine is twenty-five pounds. In the middle and northwestern States and in Oregon this timber is often found having a seasoned weight of thirty pounds to the cubic foot.

5. *Hackmatack* or *tamarack* is the American larch. It is a very important wood to the ship-builder, every way superior to the European larch, and is becoming rare in the United States. In the British provinces it is a flourishing tree, not unfrequently found growing on hard and dry soil, and of superior quality; but in the United States the hackmatack is confined in its growth principally to the swampy parts of the pine districts of the northern States. The timber is not large, but well adapted to the top and deck framing of vessels. It is also used for ceiling, beams, and stanchions; and the roots for knees, breast-hooks, sharf-floors, and futtocks are excellent. For lightness, strength, tenacity, and durability combined hackmatack is unequalled. It is cheaper in price than any other standard timber. Vessels have been built of hackmatack in every part. The extreme stiffness of the planks was modulated for bending by the use of steam in the customary way, except that a moderate quantity of fish oil was supplied in the boiler for the purpose of aiding to soften the wood.

Hackmatack is more tenacious of spike or square bolt iron fastening than most kinds of oak, and weight for weight in the green state, or half seasoned, is considerably stiffer and stronger than white oak. This is due, no doubt, to the gummy nature of the wood, as well as to the closeness and compactness of its fibre. The sap-wood should be excluded in building; the heart-wood requires no seasoning before use, as the shrinkage in weight in seasoning is less than two pounds per cubic foot. It affords very good treenails for fastening soft wood planks.

6. *Yellow locust* is the strongest timber, bulk for bulk, to be found in the United States. It is of a greenish-yellow color, and for pins or treenails for fastening the planks of ships, it has no equal in either the New or Old World. For strength, durability, and tenacity it is, indeed, remarkable. It is very generally selected for bulwark stanchions in first-class ships, and is also used for top-timbers. The smallness of its growth, together with its extreme cost, prevents an extensive use of locust in ship-building.

The cultivated locust is the most valuable, being clearer from defects, the chief of which is caused by the ravages of the grub-worm. The timber grown in

Connecticut and on Long Island, near New York, is deemed to be the best; but the middle, southern, and western States produce good timber. The density of seasoned locust exceeds that of any timber used in ship-building, except live oak. The green timber weighs about sixty-two pounds, and the dry about fifty-four pounds, to the cubic foot. This tree grows very rapidly in its natural soil, and should be cultivated for timber. It is taken to market in round logs, of nine inches diameter and upwards, cut into convenient lengths.

7. *Red cedar* is a tree of southern origin, and of most prolific growth in mountainous districts. The wood excels in fragrance, fineness of grain, solidity combined with lightness, and durability. It is not of large size. Like locust, it is mostly used for bulwark stanchions and top-timbers; and unlike most other ship-timber, the knottiest sticks are preferred, provided the knots be hard and solid. Red cedar requires no seasoning for use, as it loses in weight less than two pounds per cubic foot. As live oak is the weightiest wood, so is cedar the lightest, in the green state, used in ship-building, and these two kinds are generally combined in alternate location in the tops of ships' frames. On the Ohio and Mississippi rivers, red cedar is in common use for hold stanchions and bulkhead plank of steamboats.

8. *Chestnut*, of the white-heart variety, furnishes a most valuable timber for vessels' frames. Its natural crooks are adapted to the largest ships. That which is used is chiefly grown in the eastern and middle States. It seldom exceeds thirty-five feet length of trunk and three and a half diameter. The grain is very coarse, soft, and concentric, with large capillary vessels. When once seasoned it refuses to absorb moisture, and hence is exceedingly durable in damp situations. For posts set in the ground it is good for a service of forty years. Its properties are strength, solidity, stiffness, toughness, durability, tenacity, and lightness. Chestnut is in general use for the futtocks and top-timbers of steamships and coasting vessels. Its seasoned weight is forty-one pounds to the cubic foot.

9. *Black spruce* is a timber of northern production, chiefly confined to the eastern States and most abundant in Maine. It scarcely exists in the lumber forests of Michigan and Wisconsin, and hence it is not in use as ship-timber on the great lakes. Wherever found, it is singularly adapted to the manufacture of the smaller spars of ships and to the masts of coasting vessels. The tree rises to a height of seventy to one hundred feet, with a diameter of twenty-four to thirty inches. There is, perhaps, no better framing timber in use, if placed in dry situations and protected from the sun and weather. Where these conditions cannot be observed, the wood is doomed to premature decay. Black spruce is used, however, with tolerable success in framing the topsides and decks of vessels, and as ceiling, stringers, waterways, and for knees. It is unfit for deck or topside planking, although we have known vessels to have been built almost entirely of black spruce. It is distinguished for strength, lightness, stiffness, and rapid drying and checking in the sun. The seasoned weight is about thirty-two pounds to the cubic foot, and the color of the wood is of a clear yellowish-white, the term black applying only to the extremely dark foliage of the tree. This is the gum spruce. White spruce is the inferior variety, of smaller growth and softer grain. It is mostly useful for sheathing the bottoms of vessels, in lieu of metal, in order to protect the planking from the ravages of the *teredo*, or salt-water worm.

10. *Black or yellow oak* is among the loftiest trees of the forest in nearly all the States, and the timber from it is sometimes used in building vessels. It is inferior to white oak in strength, contains more sap in the green state, and when first cut contrasts strongly in color, but when water-soaked in rafts and partially seasoned, readily passes as good *oak* timber. The form of the leaf resembles that of the red oak, and the quality of timber is also analogous, though better. It should be seasoned as much as possible before using, and will then be found serviceable timber. This oak yields a brownish-yellow dye, called quercitron.

11. *Hard maple* includes the two varieties of rock or bird's-eye and the black maple, and both yield sugar, and hence are called sugar maple. These trees grow to a large size, and afford the very best timber for keels, floors, and submerged planking. The grain is fine and close, and wears smoother than white oak. Strength, solidity, elasticity, toughness and tenacity, and—if under water, may be added—durability, are the distinguishing properties of maple. Where dirt and damp come in contact with this timber it soon decays. It is about equal to chestnut in weight.

12. *Hickory*, of any variety, is in limited employment in ship-building. The white makes excellent timber for keels, capstan bars, and belaying pins. It would make good flat floors and bottom plank. The wood possesses great strength, solidity, and tenacity, but will not long endure when exposed to heat and moisture. On the great lakes it is deemed the best timber for jib-booms. The *walnuts* are nearly allied to the hickories, but possess greater durability. *Black walnut* is sometimes used for frames, and for deck plank and bowsprits. It has become too valuable as an ornamental wood to be used in ship-building, except for finishing. *Butternut* also makes good timber, but is very little used.

13. *Beech, red and white*, have been extensively used in the ship-yard. The red variety is most highly approved, and is found chiefly in the eastern States. The white beech is more widely diffused, but inferior in durability. This is owing in part, perhaps, to the extraordinary thickness of its rind of sap wood, to remove which, in squaring the timber, would involve an enormous waste of wood. In the red beech of mature growth, the sap wood is not disproportionate to the bright red heart-wood, and in converting the timber the former is worked off. The tree grows to a fair size, and like the live oak and the chestnut, it affords excellent crooks in the trunk for the larger timber of ships' frames. The limbs and roots, however, are smaller and more numerous, furnishing no crooks of consequence. The straight trunks make excellent plank-stocks for an average length of thirty-eight feet. Red beech is an excellent material for frames and planking, and also for treenails. The wood is of about the same strength and density as white oak, and is principally employed in Maine.

14. *Birch, black and yellow*, are northern trees of considerable importance for ship-building. The black birch is of stately growth, rivalling the white oak in length and size of trunk. It furnishes stem pieces with the root, and keels, keelsons, stern-posts, deadwoods, floors, futtocks, and bottom plank for the largest ships of eastern construction. The grain is finer than that of yellow birch, which grows faster and matures sooner, and has less size and durability. Birch in the green state is easily worked; it shrinks considerably in seasoning, and is then quite hard. The toughest and most durable timber is that found on the islands and sea-coast, and is twisted and curled in the grain.

15. *Rock elm* is tough and very flexible; it has been used in nearly every part of vessels' hulls, but is not very durable above water. It may be used in the bottoms of vessels, and will there prove as durable as oak, though the wood is too easily bruised and split to be well adapted for keels. The best quality of timber is of northern production, and in many parts of the country it is plentiful. It is used in the navy-yards for gun-carriages, and on the lakes for planking and ceiling steamboats and vessels.

16. *White ash* furnishes exclusively material for oars and the shells of tackle blocks. The wood is very strong, elastic, and tough, and has no superior for these and other uses. It makes good top-timbers, stanchions, and rails, and is often selected for jib-booms, topmasts, and light spars. It should be seasoned slowly to avoid checking and splitting. Logs should be peeled when cut, and kept under water until converted; if allowed to lie with bark on they will sprout and grow, and rot prematurely; and if peeled and exposed to the sun and air they will spoil by checking. In its native north, the white ash is one of the most beautiful trees of the forest; it grows to a moderate size, straight and tapering,

and, however long, can be riven from top to but. No other hard wood will burn so readily in the green state; consequently, it is a favorite tree for firewood in the logging camps of the lumbermen. It is lighter than hickory, and more durable than oak, and healthy in its growth to a remarkable degree.

17. *Red pine* is a species of northern wood, often denominated *Norway pine*, and is admitted to membership with ship timber woods in the northern, eastern, and Pacific States. It is found to be first-class material for top timbers, beams, deck plank, bulwarks, and ceiling. The trees attain only a moderate size and length compared with those of white pine; but the wood is denser and stronger, and reddish in color, the sap-wood thick, and showing the *sponginess* peculiar to turpentine-producing pines. The sap-wood soon blackens and rots. Red pine affords excellent timber for masts, when large enough, and for all kinds of small spars. The roots make very good knees and breasthooks, worked clear of sap wood, as should be done in all cases. In Oregon vessels have been built entirely with red pine.

18. *Bald cypress* is a native of southern swamps, where it attains an altitude of 120 feet, with a straight tapering trunk 60 or 80 feet in length. Its inaccessible location has hitherto prevented its cutting and manufacture for general use, but it will yet be made to yield valuable timber for ship-building. The wood is comparatively light, strong, and durable, and may be substituted for nearly all the purposes of yellow or pitch pine, with which, also, it is nearly equal in density. It is manufactured in Louisiana, and may sometimes be found in use as deck plank on western river steamboats.

19. *Sweet gum* is of southern growth, and limited employment in ship-building, being occasionally put into the keels, frames, and deck frames of small vessels built in Virginia, and further south. It is, however, worthy of more general employment, as it is both strong and durable.

20. *Poplar* abounds chiefly on the western and southern rivers. It is now used almost exclusively on the Ohio and Mississippi for the carpenter and joiner work of upper-deck cabins of steamboats in the place of pine, it being stronger, tougher, and cheaper. It has been in use eight or nine years, and is chiefly manufactured in Indiana.

21. *Mahogany* is often found on board well-finished ships, where it is selected mainly for ornamental purposes. It makes good timber for tops of frames and rail stanchions, hatch-coamings and cabin finishing lumber. The tree is of rather rare growth in Florida and Texas.

THE CUTTING AND MAKING OF SHIP TIMBER.

The cutting and making of ship timber in the United States has frequently been entered upon and prosecuted as a special branch of business by persons styled timber-getters, who prospect the wooded regions of the country, and select the most eligible locality for their operations. This is generally some point accessible to water transportation; hence, the forests skirting the banks of water-courses are first stripped of timber trees. Of late years the numerous railroads have afforded excellent facilities for opening new cuttings, and the ship-builder is at no loss for supplies of timber.

In many parts of the country the farmers are accustomed to cutting a few sticks of timber each year and taking it to the nearest market for sale; while, in other places, ship-builders go themselves to the woods, and there select and cut their timber. As a general thing, supplies are not accumulated except in the United States navy-yards and the largest seaports.

Getting ship timber, like all other branches of lumbering, is generally carried on in the winter season. This is not so much on account of winter being the proper season for cutting timber, as for the practical reason that the winter season, whether north or south, is the time most favorable for the work. In the north

the streams and the swamps are frozen, and the ground covered with snow, so that the hauling may be done with the *sled;* while, in the south, the sultry heat and myriad swarms of mosquitoes have disappeared from the swamps and the plains, thus greatly facilitating the labors of workmen and teams.

It may be thought that the economy of timber-getting must needs harmonize with a true philosophy of felling trees. That it does in the case of white oak is quite clear. In regard to yellow pine, we have seen that the logs and square timber cut and hewn in the summer season either contained less sap or seasoned more rapidly than logs and timber cut in the winter season. In point of fact, the specific gravity of round logs and square timber cut in the summer season is *less* than of those cut in the winter season, the greater difference being in the case of the round logs. Perhaps a contrary result would have been anticipated on account of the flow of turpentine being greatest from March to October. Whatever the cause of this increased density may be, the fact remains, and the deduction to be made may apply equally well to all turpentine, pitch, or balsam producing trees of the country. Whether this be so or not, one thing is certain, the truth of the matter has not yet been discovered by the only proper tests—*experiments for that purpose.*

There are instances of timber-getters pursuing their vocation the year round. Those who do so must surely cut some timber out of season, for it is a law of organic chemistry that trees in the temperate zone should be cut when containing the least sap, or in those months when their specific gravity is least. If green trees be felled when the vessels and cells are overflowing with fluids and juices, we may look assuredly for diminished durability in the timber.

No previous preparation of trees to be cut is practiced, such as the removal of the bark, or girdling above the roots, as earnestly recommended by various authorities. Timber that has been *killed by inches* before cutting, in whatever manner, is held in doubtful repute by ship-builders in the United States. Railroad authorities refuse to accept ties as first-class in quality, which have been made from *girdled trees.*

The mode of cutting ship timber is peculiar in this—that many of the trees of the harder woods, and a few of the softer, are taken out of ground *by the root.* The purpose of this operation is twofold: first, to secure the crook, which is most valuable with the root; and, second, to get the toughest and most durable part of the tree for timber. Very large trees, however, are seldom cut in this manner. Oak, hackmatack, chestnut, birch, maple, and spruce furnish the best grown roots for timber. The hackmatack is remarkable for having a principal root, which sometimes equals in size the trunk to which it belongs.

In cutting by the root, the principal, or that selected as the best one, should be first cut entirely off at the proper length; then the side roots; and last, the back root. Care should be taken to clear away all the small rootlets growing from the under side of the selected root. When the tree is down, cut in a few inches to the pith, and ascertain if the butt be sound or not; if sound, examine the trunk closely to see if it be free from injurious defects; if so, try the top, where, perhaps, one or more good crooks or knees may be obtained; having found the trunk sound, next cut it off at the lengths required, converting it to the best advantage. But let no time be spent on wood which is not perfectly sound.

When trees for timber are not cut by the root it is the practice to fell with the axe or saw quite close to the roots, unless it be ascertained that the butt is unsound, and would require to be recut when the tree shall be down.

Much of the timber used in the United States is got on contract for the vessels into which it is put, and the supply for the navy yards is usually obtained in this way. In such cases the timber-getters are guided by rough moulds or diagrams of the crooked pieces required, which are usually worked two inches larger each way than the net siding and moulding size, and cut six inches longer at each end

of the stick. The various sorts of timber supplied to the ship-yard may be grouped as follows:

1. Piece timber.
2. Flitch timber.
3. Plank stocks.
4. Planks.
5. Promiscuous timber.
6. Deck plank and finishing lumber.
7. Masts and spars.
8. Knees.

1. *Piece timber* includes keels, keelsons, stems, stern-posts, rudder-stocks, beams, and crooks for the frame. First-class pieces of keels, keelsons, and beams are dressed to sharp corners. Stems, stern-posts, rudder-stocks, and many of the crooks are cut by the root, and hewed to the forms required. These pieces are all lined straight the siding way, and curved as required in the moulding way, proper allowance being made from the net size and length for dressing the timber in the yard. In some markets piece timber is sold and bought by the piece; in other markets by the ton, and also by the cubic foot. The dealers in ship timber generally sell by the set (of floors or futtocks) and by the single piece.

2. *Flitch timber* is the name given to timber obtained from the saw-mills, the logs in bark, from 14 to 24 feet long, being sawed alive into flitches or thicknesses of timber corresponding with the siding size of the pieces to be worked from it. This class of timber has of late years, in a great measure, superseded that of natural crooks for the frames of vessels. It is almost exclusively used for this purpose on the great lakes and the western rivers, and to a considerable extent on the sea-coast, in the construction of steamboats and coasting vessels. The objection to its use arises solely from the weakening influences of the cross-grain which is given to every crooked piece thus forced out of straight timber. Only the most cohesive kinds of timber should ever be used for flitch. This class of timber is sold by board measure on the lakes and western rivers, and by cubic measure generally on the coast. It always brings the lowest price.

3. *Plank stocks* are the trunks of trees thirty-five to sixty feet long, the average length of a first-class quantity being forty-three feet. They are hewed straight the siding way, and may be straight, or have a long fair sweep, the other way. Both sides are lined tapering, in conformity with the growth of the tree. The small end should not be under twelve inches in size, clear of wane; nor should the wane exceed one-fourth of the width of the face of the stocks as squared. The ends should be sawed off to sound and perfect wood. At the mid-length of the stock, the breadth and depth is taken and considered the size for measurement, which is by the cubic foot, usually. In the navy yards the measurement of sap wood is disallowed. Axe marks and improper squaring constitute defects, and have allowances made for them. White and yellow pine stocks are lined straight all around and corners to square corners, with the top end not less than four-fifths the size of the butt.

4. *Planks* are sawed by mills from round or squared logs, either straight or sweeping on the edge; they should average forty to forty-five feet in length; be sawed to full and even thickness; have the heart taken out, and the bark and sap removed from the edges, in order to be first quality. Planks are sold by board measure, the breadth and thickness being taken in the middle. The most of the plank used in ship and boat building are now sawed by the mills; they come cheaper than those whip-sawed from stocks, but are never so evenly cut. and cost more for squaring and finishing on the vessel.

5. *Promiscuous timber* is prepared with a view to its answering for various purposes. It may be dressed round, flat, or square. When flatted it is usually sided straight, either to the required size or as the trees grow, and of such lengths as may suit the market. Squared timber is made as the trees grow, two sides being lined straight, the other sides following the curves of the tree. The measurement is either by the cubic foot or board measure. Round logs are

measured by taking three-fourths the mean or middle diameter, and considering it as the square of the log. This class of timber is very largely supplied to the ship-yards in rafts, pine being mixed with oak, or the oak placed on the top of the pine logs to sustain the former.

6. *Deck plank and finishing lumber* are almost invariably obtained from the mills, and should be sound, free of sap wood, shakes, rotten, black or large knots; sold by board measure. It is quite a common practice now to have deck plank dressed and planed to width and thickness by the planing mills, and the same is the case with bulwark and cabin lumber.

7. *Masts and spars* are generally obtained by the pine lumbermen, but are sometimes hunted by the timber-getters and the ship-builders. When masts and bowsprits are to be built of more than one piece, the pieces are hewed straight and square, and large enough over the required size to exclude the sap wood when dressed in the yard. Allowance of two feet over length is made, so that the holes for the chains used in rafting may be cut off when the pieces are finished. When masts are to be made of one piece, they are got in the round; the over-size of the butt is commonly reduced by eight-squaring, and the bark is removed from the remainder of the piece. No sap wood is to remain on a piece when worked to the net size, and sudden crooks, rotten or over-large knots, splits, shakes, rot, or chafes constitute inadmissible defects in first-class pieces. Mast pieces are now generally sold by the piece or by the running foot of length in the rafts. Formerly, the measurement was cubic, and taken by the girth line for round pieces. As the larger pieces are coming more into demand with the increasing size of vessels, which is more particularly the case on the great lakes, so is the distance to haul them increasing every year, and so also is the price advancing. They are generally brought to market in rafts, but sometimes by vessels and railroads.

White, red, and yellow pines are the standard woods for masts and bowsprit pieces. The proportion of net deck diameter to length, in round pieces of *red* and *yellow pine*, varies from one inch (of diameter,) to three and a half and four feet (of length,) according to the style of rig adopted. For *white pine* masts a greater diameter is allowed, namely, from three to three and a half feet of length to the inch of diameter, taken one-eighth the length of the piece from the butt. The top end of the piece should square about two-thirds the deck diameter clear of sap wood. *Spars* include all topmasts, booms, gaffs and yards, and are best left in the round, or, if red and yellow pine, with the sap eight-squared off according to an outline of the proper form. Spruce spars for the navy are left in the round in bark, and are kept under water until used. Such as measure from four to ten inches inclusive, and under forty feet in length, are denominated *measurement* spars, and are measured by the inch, taking the diameter clear of bark one-third the length from the butt. Those under four inches are considered *poles* and are sold by the piece. All above the size of *measurement* spars are bought by the piece. Those of seven inches and less must have five feet of lengths to the inch of diameter, and all above seven inches must have four feet of lengths for each inch of measurement. Pine and spruce spars, of all sizes and lengths, are also sold by the running foot, and frequently by the stick, or the measurement inch.

8. *Knees* are obtained from the limbs and roots of trees. Live and white oak knees are from limbs, and hackmatack, spruce, and pine from the roots. They are usually sided in the body to the thickness of the limb or root (arm) at its mid-length, and measured by the inch in this manner: Three-fourths of the siding diameter of the arm, at two-thirds of its clear length from the body, is taken as the net siding to which the knee must work, and which is the size paid for. The lengths of the arm and body must be in proper proportion to the net siding. For knees to be delivered at the navy yard, this proportion is as follows:

Net siding.	Length of body.	Length of arm.
5 inches	4 to 6 feet.	3½ to 4½ feet.
6 inches	4½ to 6 feet.	4 to 5 feet.
7 inches	5 to 7 feet.	4½ to 5¼ feet.
8 inches	5 to 7 feet.	4¾ to 5¼ feet.
9 inches	5½ to 7½ feet.	5 to 5½ feet.
10 inches	6 to 7½ feet.	5¼ to 5¾ feet.
11 inches	6½ to 8 feet.	5½ to 6 feet.
12 inches	6½ to 8 feet.	5½ to 6 feet.

An increased price is allowed in proportion to the length of arm and body, the length of the arm to be measured from the centre of the body. The moulding size of the end of the body to equal the net siding; and the size of the throat to the corner of the breach must not be more than three times nor less than twice and one-half the rough siding of the knee. No wood to be taken from the inside of the knee, but the outside may be trimmed square. Knees that are square and in-square are of standard value; out-square knees not to exceed sixteen degrees, for which the price is three-fourths of the square knees. Limb knees are preferred to roots, except of hackmatack. Knees for the use of the navy are generally bought in open market; and the highest prices are necessarily paid, on account of the difficulty of procuring so great a proportionate length of arm. Ship-builders do not generally require the arm to exceed six inches in length for each inch of net siding, and this is about as long as knees can be readily procured. Nor are they so particular about the arms being a few degrees out-square as to make a distinction in the price, which is often fixed at so much for each knee of each size.

THE WASTE OF WOOD IN MAKING TIMBER.

So long as ours remains essentially a wooded country, it will probably be in vain for private individuals to protest against the girdling of the whole forests of white oak, yellow pine, and other kinds of ship timber trees, or to say aught against consuming by fire in a day those majestic productions of nature which have taken hundreds of years to mature, and which are often more valuable for the timber than the cleared soil for agricultural purposes; but the waste of timber wood by those who get it in the forest, is a matter that may be considered very properly in this article.

Too great a proportion of the tree is converted into chips and blocks, and left to perish on the ground. This waste is consequent upon getting the timber of large trees to four square corners, or nearly so, in order, first, to work off the sap wood; and, second, to bring the stick down to the dimensions required in the contract. This custom was once quite harmless and convenient, when forests abounded, and steam power was not so generally employed for sawing up the timber. Now that our forests are largely consumed, the value of timber constantly increasing, and steam power to be found in or near every ship-yard, this practice has become unnecessary and wasteful, and should become obsolete. While it is proper that all sap wood should be worked off the timber before going into place in a vessel, it does not follow that this should be done at the sacrifice of fully one-quarter of the heart wood, which might be saved as available timber in converting a tree. This work can be better performed in the ship-yard, where every foot of timber is valuable.

EIGHT-SQUARING TIMBER RECOMMENDED.

Take the case of a stock of white oak timber, (got by Fowler & Kelsy, of Wallaceburgh, Canada West,) which was claimed to have been the largest

stick of white oak ever made on the continent of North America, measuring 51 feet in length, squaring 40 by 41 inches in thickness and depth, and containing 580.83 cubic feet. It would require a top diameter of 57 inches, and probably a butt size of 63 inches, to make such a stick, provided it was quite round and straight. The mean diameter would not be less than five feet. In working this tree to the dimensions given, four great slabs, averaging ten inches in thickness, would have to be chopped and split off. Suppose that this log had been eight instead of four-squared; in that case, only three inches would have been slabbed off from eight sides, which would have left (on the stick) four thick plank—six inches thick and twenty-two inches wide, if brought to square edges—to be sawed from the stick when converted in the ship-yard. These planks would be of the finest wood in the tree, and measure nearly 38 cubic feet each, or 152 cubic feet in all. Thus the waste of wood was equal to a stick of timber 22 by 24 inches, squared, and 51 feet long; and the percentage of waste was twenty-one per cent. of the quantity which might have been utilized. If we take an example from yellow pine timber, similar results will be disclosed. Messrs. Sneeden & Co., who built the steamboat Metropolis, in New York, used in her construction one of the largest sticks of yellow pine timber ever brought to that city. It forms part of her gallows frame, and measured in the log 81 feet long, 42 inches square at the butt, and 23 inches square at the top end, containing 594 cubic feet. It was hewn to sharp corners, clear of sap wood, and brought one dollar per cubic foot. This stick, with others, was towed from North Carolina in a raft. It would require a top diameter of 33 inches clear of sap, and a butt size of 60 inches, clear of sap wood, to make such a stick, provided it was perfectly round and straight. The mean diameter, within the sap wood, would be 46.5 inches. If this log had been eight instead of four-squared, then only two inches' thickness of the heart wood, instead of seven inches, would have been slabbed off each side, and there would have remained on the log four planks 81 feet long, and averaging 18 inches wide, if squared on the edges, and 5 inches thick, containing 202.5 cubic feet, equal to a log 81 feet long, and 18 by 20 inches squared, which was chopped into chips and blocks, and left in the swamp, under the wasteful system of four-squaring stocks and promiscuous timber. This stick might have been brought to market containing 796 cubic feet. The increased cost of hauling it to the water would be fully compensated by the diminished labor of scoring and hewing; and so the value of the wasted wood, as timber, is, in the end, mainly lost to the consumer; because the timber-getter must needs be compensated in price for what has been sacrificed in quantity, which was in this case 25 per cent., at least.

THE PRICES FOR SHIP TIMBER.

The principal markets for ship timber are in the ports where building is carried on. At present the trade is very dull on the Atlantic coast, very brisk on the great lakes, and fair on the Ohio and Mississippi rivers.

Table showing the prices paid for ship-building supplies at the respective navy yards named, under contracts during the fiscal year ending June 30, 1867.

NAVY YARD PRICES.

Articles.	Portsmouth.	Boston.	New York.	Philadelphia.
White oak plank stock logs		60 cents per cubic foot		
White oak keel pieces 40 to 60 feet long		95 cents per cubic foot		
White oak curved timber		64 cents per cubic foot		
White oak plank 3½ to 4½ inches thick	$70 per M feet	$70 per M feet		$48 per M feet
White pine boards 1 to 1½ inch thick, 20 to 30 feet long.		$50 per M feet	$44 per M feet	
Yellow pine logs	50 cents per cubic foot	49 cents per cubic foot	49 cents per cubic foot	
Yellow pine beams 35 to 52 feet long			60 cents per cubic foot	
Yellow pine mast and spar timber		80 cents per cubic foot	80 cents per cubic foot	89 cents per cubic foot
White pine deck plank 4 by 7 and 3 by 6	$70 per M feet			
White pine stage plank, 3 inch	$30 per M feet			
White pine mast timber	$300 per piece, 85 feet long		$200 per piece, 70 to 85 feet long	$240 per stick
Do	$250 per piece, 80 feet long			
Do	$225 per piece, 72 feet long			
White pine plank		$40 to $50 per M feet, 1 to 5-inch		$70 per M feet, 2½ to 6-inch
White pine boards			$60 per M feet, ½ to 4-inch	$49 per M feet, ⅝ to 1-inch
Hackmatack timber		49 cents per cubic foot		48 cts per cubic foot, 33 ft. long
White ash plank	$60 per M feet, 2 inch	$60 per M feet	$48 per M feet	$50 per M feet
Ash oars		9½ cents per cubic foot	9½ cents per cubic foot	
Hickory bars			$3 20 each, 12 to 14 feet long	
Cypress boards and planks	$75 per M feet	$75 per M feet	$60 per M feet	
White oak staves	20 to 25 cents per piece	20 to 30 cents per piece	12 to 22 cents per piece	
Black spruce spars	$40 each, 72 feet long		$70 each, 70 to 75 feet long	$25 each, 60 feet long
Do	$25 each, 65 feet long		$60 each, 65 to 70 feet long	$20 each, 55 feet long
Do	$2 40 each, 20 to 40 feet long		$40 each, 60 to 65 feet long	$16 each, 45 feet long

White oak knees are generally bought in open market for cash, and cost about as follows: White oak knees, 6-inch, (limbs square 4-inch square,) 7-inch, 8-inch, 9 inch, 10 inch, 11-inch, per piece, $6 to $6 50, $8 50 to $10 50, $11 50 to $14 40, $18, $21, $23 65.

Market value of ship timber at New York and Boston, January, 1867.

Description of timber.	NEW YORK. Per cubic foot. Least.	NEW YORK. Per cubic foot. Most.	NEW YORK. Per cubic foot. Average.	BOSTON. Per ton. Least.	BOSTON. Per ton. Most.	BOSTON. Per ton. Average.
White oak, crooked	$0 75	$1 00	$0 85			
White oak, round				$12 00	$15 00	
White oak, straight	47	50	48			$20 00
Live oak, rough squared	1 50	2 00	1 75			
Yellow pine, rough squared	40	60	45	35 00	40 00	
White pine, rough squared	30	40	35			
Hackmatack, rough squared	35	40	38	10 00	14 00	
Chestnut, rough squared	38	50	40			
Spruce	25	30				
Locust, round	95	1 50	1 10			

Market value of oak and hackmatack knees, rough sided, at New York, January, 1867.

	Inches sided. 6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	13 in.	14 in.
Oak, each knee	$3 50	$4 50	$8 00	$10 00	$12 00	$14 00	$18 00	$25 00	$35 00
Hackmatack, each	2 50	4 00	6 00	8 00	10 00	11 00	12 00	13 00	

The oak knees come from the eastern, middle, and western States. Hackmatack comes principally from Maine, New Brunswick, and Prince Edward Island; and many are produced in northern Michigan, where they are sided with a circular saw.

Market value of ship timber on the Ohio and Mississippi rivers, at the respective places named, January, 1867.

Description of timber and plank.	CINCINNATI AND PITTSBURG. Board measure. Least.	Most.	Average.	LOUISVILLE, JEFFERSONVILLE, AND NEW ALBANY. Board measure. Least.	Most.	Average.	ST. LOUIS AND VICINITY. Board measure. Least.	Most.	Average.
White oak flitch			$25 00			$25 00			$30 00
White oak, squared	$25 00	$30 00				30 00			40 00
White oak long plank	30 00	40 00		$35 00	$40 00		$30 00	$80 00	
White pine deck plank			50 00			50 00			60 00
White pine cabin lumber	35 00	60 00	50 00				40 00	60 00	
Poplar cabin lumber							30 00	50 00	
Red cedar lumber			30 00				25 00	30 00	
Cypress deck plank			55 00						55 00

Pittsburg and Cincinnati are chiefly supplied with oak timber in rafts from the Alleghany and Monongahela rivers, in Pennsylvania. The timber is abund-

ant. Louisville, Jeffersonville, and New Albany also receive oak timber in rafts from the same sources. Deck plank and pine lumber come from Michigan and Pennsylvania, and oak flitch and poplar from the vicinity. St. Louis, Carondelet, and Cairo are supplied from the upper tributaries of the Mississippi and Ohio, and from Illinois and Michigan with all building materials, except red cedar, which is manufactured in Missouri. Before the war, prices were about two-thirds of the present rates.

Average market value of ship timber on the northern lakes, at the chief building ports of each, respectively.

Description of timber and plank.	ONTARIO.	ERIE.	HURON.	MICHIGAN.
	Board measure.	Board measure.	Board measure.	Board measure.
	Average.	Average.	Average.	Average.
White oak flitch	$30 00	$28 00	$20 00	$22 00
Chestnut flitch	....	25 00	....	....
Hackmatack timber	....	....	18 00	20 00
Red cedar timber	....	25 00	....	....
White oak, long squared	30 00	28 00	20 00	26 00
White or red pine, long squared	....	....	20 00	35 00
White oak long plank	40 00	38 00	25 00	30 00
Rock elm long plank	30 00	30 00	25 00	....
Hard maple	28 00	....	....	....
White or red pine deck plank	45 00	45 00	30 00	45 00
White pine cabin lumber	55 00	55 00	45 00	55 00
Oak knees, per inch	25	25	20	25
Hackmatack knees, per inch	22	25	18	25
Mast pieces, per running foot	1 50	1 50	1 00	2 00

The builders of lakes Ontario and Erie are in some measure supplied with oak timber from Canada West, which indicates that it is getting scarce along the southern shores. Lake Huron county is new, and consequently all kinds of timber cost the least there.

THE SUPPLY OF SHIP TIMBER.

While it is true that the United States is rich in supplies of timber of various kinds adapted to ship-building, it is unquestionably the fact that of those kinds most in use and so generally preferred, the country is rapidly losing its stock, and vessels are becoming costly to build with the vanishing of our pre-eminence in timber resources. Several of the older States are already stripped nearly bare of white oak, and now draw their supplies from the newer States of the great lake region. The Atlantic ship-builders have already in their yards timber, plank, and knees from Indiana, Michigan, Wisconsin, and Canada West. What is true of oak is rapidly becoming true of white pine, which, for deck plank, is even now shipped from the lumber regions of Michigan, Wisconsin, and Minnesota to the ports on the Atlantic and to those on the Ohio and Mississippi rivers. The rapid disappearance of the yellow-pine forest of the seaboard caused the government, several years since, to withdraw from sale its pine lands in certain districts of Florida; and for a long period prior it has endeavored to protect the live-oak woods of the same State from the axe of the foreign contractor.

It is not, perhaps, generally known that *France* now depends very much on

the forests of the United States for her ship-timber; yet so it is. The timber getters are constantly at work (we presume they were only interrupted by the war) for French agents, cutting down the yellow pine woods of Florida and Georgia in the south, while the exportation of *two and a half million feet of white pine deck plank* from Saginaw, in Michigan, to Havre, in France, the present year, will show that their visits have been likewise extended to the pineries of the north. This quantity would cover the decks of not less than *fifty ships*.

In fact, our white-oak and yellow-pine forests are ravaged by everybody for indiscriminate purposes. From navy-yards to cooper-shops, from railroads to street alleys, and from bridge-building to shingle-making, there is no quarter given to the oak and no peace to the pine. When we reflect that more than *sixty trades* and nearly *half a million artisans* flourish and prosper by consuming wood in manufactures in the United States, and that by far the greater proportion of woods used are the very kinds preferred in ship-building, it will become manifest that there is real cause for serious consideration of the subject of future supplies. Ship-timber now costs nearly or quite double what it did ten or twenty years ago; and what is more, certain influences are at work narrowing the circle of woods eligible for construction, and thus increasing the difficulty of building a vessel for a moderate price. It will yet become a question of some importance among ship-owners whether there are not other timber growths than oak and pine to be found in the forests of the United States from which good and durable vessels may be built for reasonable prices. When a full and complete course of mechanical and philosophical experiments shall have made the commercial community acquainted with the *timber properties of all the trees* of our great country, of which the wisest must confess the want of information up to this time, many will wonder at the present general assumption that only a few kinds of trees would furnish timber fit for ship-building.

THE UNDERWRITERS' RULES LIMITING THE SELECTION OF SHIP-TIMBER.

The influence of underwriters' rules in limiting the varieties of timber to be put into *first-class* vessels, operates to create a scarcity in the future markets and to advance the prices of the present. That it is necessary to classify vessels, and proper to influence their right construction, no one will deny; but that hastily formed rules should be established and rigidly adhered to, whereby the various kinds of woods entering into vessels shall be arbitrarily classed, without regard to their inherent properties, or to the conditions of their culture, growth, age, and season when cut, or the mode of manufacture into timber, seasoning, age of the manufactured stock before use, or the means adopted for its preservation, is, to say the least, a summary method of concluding a difficult matter. By this system of classifying *woods*, instead of vessels, the labors of inspectors are very much simplified and abridged, it is true, but its operation is not promotive of justice and progress, nor of the interests of underwriters. If a mark of disapproval be put upon a certain sort of timber by rules of classification, that kind will, of course, be thereafter excluded from the ship-yard; but it may be just as good as another kind allowed to be used, which, perhaps, has laid several years around the yard, or is old and brittle, or cut in the wrong season, or is green from the stump, or of defective antecedents of some sort, none of which are noticed if it be "all oak" and set down in the catalogue. The lake underwriters' board have recently disallowed the use of black birch timber in floors, keels, and plank below water, chestnut in top-timbers and beams, beech and rock elm in keels and plank of bottom, and pine roots for knees and breast-hooks. These woods, hitherto allowed for the parts named, cannot hereafter be used at all in first-class vessels.

The underwriters' surveyor would be an important personage in a ship-yard if he was qualified for his business and had, at least, a moderate measure of dis-

cretionary power. At present he is hampered with rules, the application of which he can make no better than the builder, so that if the latter observes the rules the inspector can have nothing to say. He may be well informed upon the subject of ship-building, and know full well that a chestnut top-timber is as good as oak in every respect, yet it is not for him to say—the rules having said to the contrary—that it may be put into the frame of a vessel, which it is agreed shall class A 1. He will refer the builder to the rules; his duty is to see and report to the board the particulars of construction. If the chestnut timbers in question be used, then is the vessel branded as one of an inferior class, and condemned, before being launched, to pay higher rates of insurance than she would do if in place of chestnut the builder had used "white oak," or tamarack or red cedar alternately with "white oak," according to the rules. Of course the chestnut is doomed to dishonor, and a higher value given to the oak; and so of other woods which have been rejected; they are practically *wasted*, because not used, and the cost of their waste is added to that of the oak.

THE STRUCTURE AND GROWTH OF TREES.

In building vessels with timber, the durability of the wood is an important matter, since, if the wood will endure, the vessel also will endure. To secure endurance, therefore, is the object of making choice of durable kinds of timber, and the *names* of these are sometimes received as a tower of strength and a bulwark of defence against every form of *rot*. In our anxiety to prolong the life of the floating structure, sight seems to be lost of the laws of life of that *vegetable* structure which is to compose the constructed ship. It seems to be forgotten that trees can be planted, cultivated, influenced in growth, durability, and preservation by careful attention to natural causes.

On examining a section of the stem of an oak or other tree we observe the following parts: First, the pith, or its remains in the centre; secondly, the bark on the outside; thirdly, a mass of wood between the two, apparently divided up into portions by the annual rings of its fibrous depositions and by a series of silver grains or ray-like lines which pass from the centre to the circumference.

The *pith* occupies the centre of the stem for a length of time, and in most trees gradually disappears, beginning at the roots and terminating at the end of each branch when the growth of the tree has ceased. But so long as the tree is living and bearing leaves, buds, and flowers, these have unbroken connection by it with the stem or trunk, from whence they derive their first nourishment and establish their first circulation when developed. It thence becomes the main organ of nutriment, and at the same time the chief depositor of the fluid secretions. The *pith* is also in equally direct and unbroken connection with the bark through the medium of the medullary rays, and it thus becomes the centre or *heart* of all the movements of sap which proceed in the cellular system.

The medullary sheath, immediately surrounding the pith, is a layer of vascular tissue. It has no special walls, but is simply bounded by the wood on the outer side, and the pith on the inner side. The integrity of this vascular structure is highly necessary to the life of the tree.

The medullary rays constitute the channels of communication between the pith and the bark, and are like a series of partition walls resting upon the root, and proceeding to the apex of the tree and radiating from the centre. They give strength and beauty to the wood, and begin to exist with the first deposited layer of wood, continuing to grow outwardly, or nearest to the bark, so long as the wood continues to be deposited.

The bark forms the outer covering of the tree. It may be considered as composed of two structures, viz., the outer one, which is cellular; and the inner one, which is vascular or woody, and forms a link between the wood and the bark. The vascular part of the bark consists of several layers of small interlaced bun-

dles of woody fibre, connected together by loose cellular tissue. It is not equally smooth on both sides, since on its outer side it has connection with the cellular bark, but on its inner surface it is opposed to the smooth wood, or is covered by the semi-fluid *cambium*, or formative fluid. Its mesh-work character permits the medullary rays to pass through it, and to keep up a circulation with the cellular part of the bark. The more apparent use of the bark is to give protection to the wood; but if the bark did not exist, there would be no *cambium*, and without this there could not be any deposition of woody fibre, and thus the presence of bark is necessary to the growth of the tree. It is also essential to the life of the tree, from its connection with the cellular system, by means of the medullary rays, and so with the undeveloped leaf-buds. The bark contains a large number of air-vessels, and not only conveys refuse matter from the leaves to the soil, but is also a depository of elaborated secretions. This is seen in the oak bark yielding tannin, the cinchona bark producing quinine, and the fir tree emitting turpentine.

The wood is the most important division of the tree. We find it occupying nearly the whole body of the trunk, and its structure arranged in a very systematic manner. The section of a stem presents to our notice a series of circles, which increase in diameter, and are separated by wider intervals as the bark is approached, and thus the trunk is composed of numerous zones enclosed within each other. Next we observe the medullary rays passing in straight lines from the pith to the bark, and widening the distance between each other, until the outer zone is passed. The medullary rays and the circular mode of deposition both tend to a less difficult cleavage of the wood, but they nevertheless bind the parts very closely and firmly together.

Wood is formed by the leaves during the growing season, (which is the one of the most light and heat,) and passes down toward the root, between the bark and the wood of the previous year, and perfectly encloses the wood of former seasons. That this is the mode of growth seems to have been satisfactorily proved by experiments. The bark exercises an influence in the formation of wood chiefly in regard to the coloring matter deposited in its cellular tissue. That the roots also exercise some influence seems to be proved by the occurrence of the thickest growth of fibre at the but, on that side of the tree where the largest *root or roots* are found. Hence the shrewd chopper, desiring to cut to the heart and "*heart*" his mate, selects that side to chop into which has the least root development, and never fails to find this the shortest cut to the pith.

The roots of trees are composed of nearly the same tissues with the stem, viz.: woody fibre, ducts, and cellular tissue. The chief functions of the roots are to sustain the tree, and to absorb from the soil and supply to its stem all the fluids and substances in solution which enter its circulating systems. Effete and deleterious substances are also emitted by the roots. Although the sap ascends through the capillaries of the wood from the roots, it flows still more copiously between the wood and the bark. If the bark be stripped from a tree, the circulation of the sap is greatly diminished, soon ceases, and the tree will gradually perish.

The *leaf* is the type of construction of the entire tree, representing, as it does, in its composition, every structure which enters into the stem, and none other. Thus there is cellular and vascular tissue enclosed on each side by a cuticle. The surface is commonly marked by a number of ridges, which are called veins, and which consist of woody tissue, spiral vessels, and cellular tissue, and they are retained in their position and the intervening spaces filled up by cellular tissue. The tissues of the veins are brought in close proximity in the *petiole*, which is a small stem, and having passed through it into the stem, one part enters the bark, whilst the other traverses the wood and penetrates to the medullary sheath, at the centre of the stem. Thus every leaf is in direct communication with the stem; and not only so, but it is a prolongation of the very pith, spinal

vessels, and wood of the stem. The similarity between the leaf and the stem may be carried yet further, for not only do the same structures enter into the composition of both, but in both there is a double set of vessels, one of which conveys the fluid from the root, and the other carries it back again to the root.

The living tree, it is seen, holds communication with the earth and water and the air by means of roots, leaves, and bark; and also that the fluids, juices and deposits depend for their movements upon the presence and action of these parts. A healthy growing tree undoubtedly produces the strongest and most durable woody fibre, because its structure has been formed under natural influences. If a tree be denied food and water to its roots, or be stripped of its leaves, or peeled of its bark, it will gradually and surely perish. If all these things be done, it will immediately cease to live *as a plant*, and may then be converted into timber for various purposes, or be left to decompose.

When a tree is cut down the circulation from the root is severed; fluids will no more enter the stem, but the leaves will continue their functions until they wither and perish, and the juices will flow into the stem for awhile from the top and branches. If when a tree is cut down it is also cut off at the top, the vertical or vascular circulation very soon ceases; but cellular or horizontal circulation still continues between the bark and the pith, and will not cease until after the bark has perished or been removed from the log. Until the plant-life of the tree be destroyed, changes and transformations will continue to be made imperfectly and unnaturally and unhealthily; and when we consider that the latest and most imperfect formations are the first to decay, another reason will appear why the felled tree should be immediately converted into timber, and every fibre of bark be removed from it.

THE PRESERVATION OF SHIP TIMBER FROM ROT.

Perhaps the most simple and practical method of preserving timber is by subjecting it properly to the action of water and air. By the action of *water* it may be deprived of all those vegetable matters contained in it which are soluble in water, and which, by heat and moisture, are caused to ferment and rot. Every species of *fungus* which can be germinated in timber can vegetate only on substances which are soluble in water. By the action of *air* the water and moisture contained in the timber may be evaporated, and the fibres of the wood be brought closer together by the loss and shrinkage of the vegetable matters deposited between them.

It has frequently been remarked that timber from the raft seasons quicker and exceeds in durability that which has not been put into the water, and that submerged timber will endure for almost an incredible period of time. The submerged keels of vessels are never removed on account of rot. One cause for this is that the water has dissolved and removed the extraneous *vegetable substances* of the timber, and another is that immersion has secured it from the action of *heat*. We see in these, therefore, the principal causes of the rot in timber, viz: the presence of vegetable matters, soluble in water; and the action of heat, which induces the fermentation of these matters, and thus forms the preliminary step towards the decomposition of all vegetable structures. By the action of *air*, timber which is to be exposed to the atmosphere may be rendered more durable by proper seasoning. It is of no use to season timber which is to be submerged, or placed in damp situations where wet and moisture inevitably will be reabsorbed. In the latter case, if the vegetable matters have not been removed, the action of moisture will gradually dissolve them, and induce fermentation under the action of heat.

Decomposition or disintegration is the natural form of decay. Its most active agent is *oxygen*. Without this agent, and the presence of moisture in the timber, and of heat above 40° F. in the surrounding medium, fermentation, which is the

first action, could not take place. After the first action a slow combustion sets in, oxygen is absorbed, and water and carbonic acid formed. By this action the tenacity and adhesiveness of the woody fibres are destroyed, and a brown or blackish friable body is produced, called *humus*. Perhaps the causes which act to deteriorate, and finally to destroy timber, may be said to begin with its conversion from the living tree, under the influence of the universal law which renders decay the necessary consequence of organization. The *operation* of this law is constant, and, although favored or hindered by circumstances, is never completely arrested, except by the employment of active and powerful antiseptic agencies. Such agencies have been discovered in the metallic salts. These substances in solution may be made to impregnate the wood, and form new chemical combinations, which remain in a state of stability, completely hindering the growth of *fungi*, and the changes producing *dry rot*.

Very crude efforts were long since made for the purpose of partially or wholly accomplishing the saturation of timber with various solutions, but few ever proved successful to a practical degree. To M. Boucherie, of France, the building world is indebted for the best method hitherto practiced of introducing metallic salts to the fibres and vegetable compounds susceptible of decay.

BOUCHERIE'S MODE OF PRESERVING WOOD FROM DECAY.

First experiments.—Dr. Boucherie's first idea was to compel trees to fill themselves with a preservative substance by their own powers of imbibition, and, to some extent, this was effected. The manner in which fluids direct themselves, when sucked in by a growing tree, was apparently capricious. Some trees, the ash for example, absolutely refused to take up the fluids presented to them. This abortive process was soon abandoned.

The next plan was to suspend logs of trees perpendicularly, and to secure a reservoir to the upper end, so that the preserving fluid might, by its own weight, sink down into the log, displacing and driving out the sap, its presence being one of the chief causes of rot. A two-fold object was thus attained, and the *green log cured in the forest* became an object of mechanical wonder.

This method was soon superseded by the present, which will now be described: Soon after the tree is felled, a saw-cut is made in the centre, (unless the timber is to be of the full length of the trunk, one stick,) through about nine-tenths of its section. The tree is then slightly raised by a lever or wedge under the cut, which is thereby partially opened. A piece of string is then placed round the saw-cut, close to the bark of the tree, the support is then withdrawn, and the saw-cut closes on the string, thereby making a water-tight joint. An auger hole is then bored obliquely into the saw-cut; a wooden tube is then driven into the hole, the conical end of which is attached to a flexible pipe, which is in connection with a cistern or reservoir, at an elevation of thirty to forty feet above the log to be preserved. In the case of a tree making but one log, the operation is slightly modified. The fluid is introduced at one end, a head-block of metal being screwed to it, and a space left between, as open as the saw-cut, and made tight in the same manner. When the log is under operation the sap runs out from the end in a clear stream, showing the amazing quantity which some trees contain. The preserving fluid will traverse a log twelve feet in length with less pressure than is required to force it laterally through a plank three-quarters of an inch in thickness. As the sap is forced out, the preservative fluid follows it, and its presence at the end of the wood is ascertained by a chemical test.

Such is the method of charging a tree, at once simple, cheap, and effectual. Experiments show that no fluid answers so well as a very weak solution of sulphate of copper, or blue vitriol. Corrosive sublimate is also efficient, but too expensive. Sulphate of zinc, acetate of lead, sulphate of iron, oil, tallow, rosin, pyrolignite of iron, all have been tried, but without entirely satisfactory results.

The first experiments were begun in France in 1842. Eight years thereafter, in 1850, three eminent French engineers made examinations and published a report relating to the successful trials of M. Boucherie's system, which is too lengthy for description here. The *results* are, that all the telegraph posts in France, and nearly all the railroad sleepers, are now prepared by Boucherie's method. Posts prepared in 1846 from fir are now in good condition, and so are ties of hornbeam, beech, and birch. In the south of France, large quantities of vine props are now prepared by this process. Some of the railroads in England have adopted the plan within the past few years. It has also been applied to ship timber. What is most important is, that the poorest and least enduring kinds of wood yield most readily to the process. Beech, hornbeam, poplar, birch, fir, spruce, alder, ash, and elm have been operated on with success. The heart-wood of oak proved impenetrable, but the sap-wood admitted the fluid copiously. Woods which naturally possess most moisture, and of the same kind—those which have grown in the dampest soils—are most easily penetrated. In short, the cheapest and least durable kinds of timber are precisely those which afford the best results when injected with the sulphate of copper.

Increase of weight follows in consequence of injecting a log, and depends, of course, upon the displacement of *air* by the liquid. That portion of the liquid which displaces the sap will not occasion any increase of weight. The extent to which air is displaced from different kinds of timber, operated on by Boucherie's process for preservation, is thus determined by the French engineers:

Beech, increased in weight	209	pounds	per 35	cubic feet.
Oak, (sap-wood only,) increased in weight	55	"		"
Hornbeam, increased in weight	46	"		"
Birch, increased in weight	$2\frac{10}{16}$	"		"
Poplar, increased in weight	70	"		"
Alder, increased in weight	156	"		"
Ash, increased in weight	50	"		"
Scotch fir, increased in weight	127	"		"
White fir, increased in weight	53	"		"

Birch appears to contain the least air, and the heart of oak none. The operation depends for its success upon the permeability of the timber, and all trees are most easily operated on when first felled, except when they may be frozen in winter. If the logs be cut in the summer it is important to perform the operation immediately, before the tubes contract or the juices begin to ferment; and if in winter, in the course of a few weeks after felling.

Objections have been raised against impregnating ship timber with poisonous solutions, lest the health of the crew should be thereby endangered; but this apprehension will be found groundless in regard to a very weak solution of sulphate of copper, when we consider that although this salt is a violent emetic in the dose of ten grains, it is astringent and tonic in less doses and in the dilute state. Common salt is also a speedy emetic, acting in doses of half an ounce, and a laxative in the dose of a drachm dissolved in a small quantity of water, and yet seamen experience neither of these effects from the salt which is often placed between the timbers of vessels' frames to preserve them. The only persons who might experience any effects from the use of Boucherie's solution would be those who impregnated the timber, and no such case has yet occurred in France.

SALTING VESSELS' FRAMES.

The substance most commonly used in the United States, when any is employed for the purpose of increasing the durability of timber in vessels, is common or rock salt. Its preservative action is limited to the absorption of water from the timber, (and surrounding air,) and perhaps therewith a small portion

of albuminous matter in solution. It also keeps the wood surfaces in contact with it cool, and thus prevents fermentation. But it cannot penetrate to a considerable distance into the wood; the surfaces will be preserved, but the interior of the timber may not be. The lake underwriters make it imperative that the upper ends of the frames be salted in new vessels of the *first class*. The American Lloyds, of New York, recommend salting, but do not make it an absolute condition for vessels of the first class.

The mode of salting is to fix stops of boards between the timbers of the frames about the height of the load line, and when the ceiling and planking are worked and the plank-sheer ready to go into place the spaces between the timbers are filled with salt. Near the ends of the vessel the salt is sometimes put between the frames quite down to the dead-wood. A vessel of five hundred tons will take a hundred barrels of salt applied in the usual manner.

There can be no doubt of the utility of salting close assemblages of timber, provided the pieces are not too large; but if large, not too green. The action of salt upon timber seems to be imperfectly understood. It is seldom applied to advantage, as may be seen from the mode of using it, namely, against the dry sides of the timbers instead of the moistened ends, which is rather impracticable. It results that water from the wood is very slowly obtained, which is shown from the length of time it takes to dissolve the salt—several years. During this time incrustations are formed over the surface of the wood; these are cooled and preserved, but the interior of the timber, especially if large, not having parted with its moisture and fermentable juices, may be decomposed, as we have seen, despite the salt. From this we are led to infer that a proper application, either in mode or quantity, would have saved the interior as well as the outside of the timber. But this is by no means certain, however. Salt, in its nature, is not constituted to perform all the functions of a perfect antiseptic for timber, and, besides, is too slow in its action. If the timbers of a ship could be made small enough in scantling, salt might answer to save them; but salt would scarcely save an ox were the carcass not cut up, and it is equally useless applied to logs of timber. It is also a most weighty and cumbersome material, and would be more so if applied to the extent required. It may occur to the reader that an injection with brine, after the method of Boucherie, would be a better application of salt, and no doubt it would be. But this has been tried in France, and failed, like many other solutions, to give the satisfaction required.

In conclusion it may be observed that a method of preserving the timber from the moment when made, is the only one which is valuable to all parties concerned. By adopting such a method timber would not then, as now, begin to rot on the hands of the manufacturer, the dealer, or the ship-builder before being disposed of. It is now quite perishable property, and should be cut and brought to market only as it may be demanded for immediate use.

HISTORY OF THE AGRICULTURE OF THE UNITED STATES.

BY BEN: PERLEY POORE, WEST NEWBURY, MASSACHUSETTS.

AGRICULTURE, although recognized as the basis of our national prosperity, has been ignored by our nation's historians. The exploits of our soldiers, the daring of our sailors, the learning of our scholars, the careers of our business men, have all been duly chronicled, yet I have never seen any connected mention of our agriculture, which (as the quicksilver in a thermometer shows the temperature) ever marks the position of a community upon the scale of civilization. It is eminently the art of the world's advanced age; its science is prospective; every day's addition to the population of a country enforces it upon human notice and intelligence with the repeated force of daily necessity. Other sciences invite man; agriculture importunes him. Clouded as its earliest annals may be, it remains ever ready to receive fresh illumination from the gradual advancement of all around it; and, as such, it will probably reveal itself more clearly with every progress made by each art and science in their respective courses. It is well, however, to preserve a record of what has been done, that the agricultural history of the United States may be as well known as is that of ancient Egypt and Rome. True, there are those who assert that history is not more valuable than an old almanac—which, for their individual comprehensions, is undoubtedly true; but as an old almanac will serve as a future guide to him whose far-seeing eye can trace the brilliant course of the celestial luminaries, so a history of our home agriculture will enable the sensible yeoman to trace the progress of our prosperity. Of course this article contains no original ideas; but the facts which it embodies have been carefully compiled from a variety of reliable sources.

AGRICULTURE OF THE INDIANS.

The North American aborigines were not an agricultural people; the cultivation of the soil was considered among them as a degrading occupation for the men of the tribes, who left it to the old women and children. Captain John Smith, who visited Virginia in 1609, says: "The greatest labor they take is in planting their corn, for the country is naturally overgrown with wood. To prepare the ground they bruise the bark of trees near the roots, then do they scorch the roots with fire that they grow no more." This custom of theirs, it probably was, that suggested to our ancestors the process of belting or girdling, which killed the larger trees by cutting through the sap-wood, caused the fall of spray and lesser branches, and thereby admitted the sun and air to the crop cultivated in their intervals—a practice which, as compared with the method of clearing off the entire growth, enables the settler of new lands to increase the area of virgin soil under culture in more than geometrical ratio; which has kept pace with our ever advancing frontier, and which, more than any other, has enabled the white race "to enter in and possess the good land that lay before them."

The land being cleared—and a field once thus prepared was used for many successive years—the squaws would make preparations for planting early each spring. First burning the dead wood on the ground, and often bringing dry branches to burn, that they might obtain their fertilizing ashes, they would then

cultivate, or rather root up the surface, with the flat shoulder-blades of the moose, or with crooked pieces of wood. They would then mark the future hills by making small holes, (about four feet apart,) with rude wooden hoes or clam-shells; put into each one an alewife from some adjoining stream, or a horse-shoe crab from the sea-shore; and on this stimulant drop and cover a half dozen grains of corn. The land thus planted was guarded against the depredations of the birds, and as the corn grew the earth was laboriously scraped up around the stalks with clam-shells, until the hills were two feet high. To use the words of Smith, "they hill it like a hop field." While the stalk and leaves were yet green, the ears were plucked. The next year's seed was selected from those stalks which produced the most ears, and was triced up in their wigwams. The remainder of the crop was carried in back-baskets to stagings, where it was dried in the husk, on stagings, over smouldering fires; then husked, shelled, packed in large birch-bark boxes, and buried in the ground, below the action of the frost. "O-mo-nee" was this dried corn, cracked in a stone mortar, and then boiled; when pounded into meal and sifted through a basket, to be made into ash-cakes, it was called "Sup-paun." The warriors, when on a war-path, subsisted on parched corn, which they called "Nokake." Roger Williams, the founder of Rhode Island, speaks of having "travelled with two hundred Indians at once, nearly two hundred miles through the woods, every man carrying a little basket of this at his back, sufficient for one man three or four days." "With their corn," says Smith, "they plant also peas they call assentamus, which are the same they call in Italy fagiolia. Their beans are the same the Turks call garnaness, but these they much esteem for dainties." "In May, also, among their corn they plant pumpeons, and a fruit like unto a musk-melon, but less and worse, which they call macocks." These additional crops not only keep the ground around the roots of the growing corn moist, but they supply materials for the celebrated Indian dish called "mu-si-quatush," which has been changed into sucatush. This was not then, however, simply composed of corn and beans, for we are told, by Gordkin, that they boiled in it "fish and flesh of all sorts, either new taken or dried—venison, bear's flesh, beaver, moose, otter, or raccoon, cut into small pieces; Jerusalem artichokes, ground-nuts, acorns, pumpkins, and squashes." At the northwest wild rice was gathered, and kept for winter use; and Barlowe, who visited North Carolina in 1584, asserted that he saw there "both wheat and oats." It is not improbable that oats were found growing wild there, as they are known to grow wild on other portions of the continent; but doubts may be entertained as to the wheat, although he, an Englishman, should have known that grain. Dr. Hawks thinks, however, that he saw some variety of the triticum, and, without critical examination, pronounced it wheat. The sunflower was also cultivated for its seeds, of which bread was made.

"Mish-i-min," in the Algonquin tongue, signifies apple; although it is the opinion of some learned writers that this fruit was unknown among them before the arrival of the Europeans. Several old printed compilations of early voyages, however, reckon apples among the early native fruits; and, unless crab-stocks were found, it does not appear how the large orchards, mentioned by early writers, could have been made productive so soon. Mr. Walcott, a distinguished Connecticut magistrate, wrote in 1635, (certainly not more than five years after his colony was first planted,) "I made five hundred hogsheads of cider out of my own orchard in one year." This would have been almost impossible, had he been obliged to raise his orchard from the seed, or had he planted trees of such a size as could have been transported through the trackless wilderness. The apple may not be indigenous to this country, and yet the Indians may have possessed it, as they did corn, which is not a native of their soil. Certain it is that they had orchards of cherries and of plums; large stores of which were dried for winter use. Tobacco was everywhere cultivated; huge grape-vines entwined many a forest tree, and there was an abundance of berries in the woods. Gourds

were raised in great numbers, and of all sizes, from the large "cal-a-bash-es" that would hold two or three gallons each, to the tiny receptacles of pigments used in painting for war.

From the sap of the maple they made a coarse-grained sugar, which, when mixed with freshly-pounded "sup-paun," and seasoned with dried whortleberries, was baked into a dainty dish for high festivals. The dried meats of oil-nuts, pounded and boiled in a decoction of sassafras, was their only beverage at such feasts; and from the green wax of the bayberry they made candles, with rush wicks, which gave clear lights, and yielded a pleasant fragrance while burning.

Their wigwams were constructed of saplings, set into the ground in a circle, and then drawn together at the top until they formed a conical frame some nine or ten feet high at the apex. This was covered with thick mats of woven grass, or with large sheets of birch bark, sewed together with the dried sinews of the deer, and then calked with some resinous gum. A mat served as a door; in the centre was a stone hearth, with an opening above it for the escape of the smoke. The only article of furniture was a large couch, elevated about a foot from the ground, and spread with dressed skins and mats. Birch-bark boxes were used to hold finery and provisions, while the framework of the wigwam was hung with war-clubs, bows, bundles of arrows, fish-spears, hoes, axes, and other rude implements which the Indians possessed. Unacquainted with the use of iron, their cutting instruments and sharp weapons were pointed with flint-stone, shells, or bones, and their earthen vessels were of the coarsest description. They had no domestic animals except a few small dogs, and no poultry.

Such was the primitive agricultural life of the Indians, who have been gradually blotted out from their pleasant homes, to make way for the "pale-faces." On many sunny slopes now smiling with cultivation were their cheerless wigwams, their crabbed orchards, and their ill-tilled corn-patches. Beneath the shade of forests long since felled, and where flourishing communities now dwell, they tracked the wild beast to his lair, or reposed, weary of the chase, to partake of their slaughtered game. Where spires now point heavenward, and the doors of school-houses "swing on their golden hinges," the war-hatchet was unburied, or the "calumet" of peace was whiffed, or the "pow-wows" went through their mystic incantations. And as we meet at cattle-shows and agricultural anniversaries, so the Indians, in their day, celebrated the "green corn dance," or the "feast of the chestnut moon."

> "Alas for them—their day is o'er:
> Their fires are out from hill and shore
> No more for them the red deer bounds
> The plough is in their hunting grounds.
> The pale man's axe rings through their woods.
> The pale man's sail skims o'er their floods,
> Their pleasant springs are dry."

SPANISH COLONIAL AGRICULTURE.

Spain having discovered America, endeavored to colonize the regions of which so many wonderful and mysterious accounts were circulated by the early navigators. As early as 1520 a royal edict, "in order the better to facilitate the emigration and permanent establishment of colonists, offered to all who wished to go, provisions for a year; to defray the transportation of their supplies and persons; exemption from all duties and imposts; and the perpetual ownership of the houses they might construct and the lands they might cultivate." But the needy adventurers who flocked to the New World sought gold and glory rather than homes and lands, especially those who landed on the shores of Florida. The expedition which landed at Tampa bay, and followed the stern De Soto to the Mississippi river, were in search of El Dorado, and had no desire to cultivate any of the fertile regions over which they passed during their toilsome march.

But the home government desired a more permanent colonization, and, in 1565, we find that Spain granted to Francisco de Eraso "twenty-five leagues square, (3,600,000 acres,) to be located wherever he pleased, in Florida, with the office of governor, and various other titles and privileges for himself and heirs, exempting them from imposts and duties, on condition that he should provide several caravals for exploration, and colonize his tract, within three years, with 500 settlers, most of whom should be husbandmen, 500 slaves, 100 horses and mares, 200 heifers, 400 swine, and 400 ewes." Several colonies were thus established, but they did not prosper, and little was done to improve the cultivation of the soil until the English took possession in 1763. When the Spaniards regained possession, agriculture was again neglected, fields were allowed to grow up with briers, and sugar-houses to rot down.

THE PURITAN ENGLISH COLONISTS.

The English Puritans, who settled in New England, were men who regarded civil and religious liberty as the primary object of rational beings. To use their own words, "they left their pleasant and beautiful homes in England to plant their poor cottages in the wilderness," that they might worship God as revelation and conscience might teach, and found a free agricultural state equal to Palestine in its palmiest days, when Israel's kings had "herds of cattle, both in the low country and on the plains, granaries for their abundant crops, husbandmen also, and vine-dressers in the mountains." The sacred light of biblical history was not to them like the stern-light of a vessel, only illuminating what had been passed over, but rather the pillar of cloud and the pillar of fire moving before them on the path of life, giving guidance by day and assurance by night. The fate of Babylon, of Nineveh, of Carthage, of Venice, of Genoa, and many commercial governments of central Europe, warned them

> "That trade's proud empire hastes to swift decay,
> As ocean sweeps the labored mole away."

In England agriculture has long been regarded as the most favorable occupation for the development of Christianity, and had, prior to the reformation, received the special attention of the clergy. The first gardens and orchards were those of the benedictine monks, and the general council of Lateran decreed that "all presbyters, clerks, monks, converts, pilgrims, and peasants, when they are engaged in the labors of husbandry, shall, together with the cattle in their ploughs and the seed which they carry into the field, enjoy perfect security; and that all who molest and interrupt them, if they do not desist when admonished, shall be excommunicated." Nor were the followers of Luther less devoted to agriculture than their Roman predecessors, especially when it was found that the doctrines of the reformed church made but slow progress in the cities and towns. Dorsetshire and Wiltshire, the English homes of the Puritans ere they made their exodus to a transatlantic Canaan, are even now remarkable for their almost total absence of the usual signs of trade and manufactures; and we are informed by Bancroft that those who first went to Holland were anxious to emigrate again because they "had been bred to agricultural pursuits," yet were there "compelled to learn mechanical trades." "They sought our shores," said Mr. Webster, "under no high-wrought spirit of commercial adventure, no love of gold, no mixture of purpose, warlike or hostile, to any human being. Accustomed in their native land to no more than a plain country life and the innocent trade of husbandry, they set the example of colonizing New England, and formed the mould for the civil and religious character of its inhabitants."

This desire on the part of the Puritans that "New England" should be an agricultural community was strikingly manifested by the corporation of Massachusetts Bay, whose charter extended from a line three miles south of Charles

river to another three miles north of "any and every part" of the Merrimac. Each contributor and each stockholder received two hundred acres of land for every fifty pounds sterling paid in, while stockholders and others who emigrated at their own expense received fifty acres for each member of their family and each "indented servant." This shows that it was a rural home in this land of freedom, and not town lots or semi-annual dividends, that these liberal adventurers sought, and we find further confirmation of their agricultural proclivities in the inventories of the supplies sent by the corporation to the new colony. "Vyne planters" are mentioned usually after "ministers;" then come hogsheads of wheat, rye, barley, and oats, unthreshed; beans, peas, and potatoes; stones of all kinds of fruit; apple, pear, and quince kernels; hop, licorice, and madder roots; flax and woad seed; currant plants, and tame turkeys. Cattle were imported by the colonists, not only from various parts of England, but from Holland, Denmark, and the Spanish Main, forming a noble foundation for the "native stock" which, when carefully reared and well fed, is at least equal to many of the vaunted imported breeds. Horses, sheep, swine, and goats were also imported from Europe in large numbers. Neither was horticulture neglected, for we find that Governor Endicott had a vegetable garden and vineyard in 1629, and two years afterwards he planted the famous pear orchard of which one venerable survivor still bears the patriarchal honors.

The rights of the Indians, it is pleasing to record, were scrupulously observed by the first settlers of Massachusetts Bay. More than fifty years before William Penn made his much-talked-of treaty with the natives at Philadelphia, announcing those principles of amity and of equity upon which he desired that their future intercourse should be conducted, the officers of the company in England wrote to Governor Endicott: "And, above all, we pray you be careful that there be none in our precincts permitted to do any injury, in the least kind, to the heathen people; and if any offend in that way let them receive due correction. And we hold it fitting that we publish a proclamation to that effect, by leaving it fixed under the company's seal in some eminent place, for all to take notice, at such time as both the heathen themselves, as well as our people, may take notice of it. If any of the savages pretend right of inheritance to all or any part of the land granted in our patent, we pray you endeavor to purchase their title, that we may avoid the least scruple of intrusion." This order was religiously obeyed, and there was hardly a town where the Indian title was not extinguished by purchase.

The immigrants found that Boston had "sweet and pleasant springs and good land affording rich corn grounds and fruitful gardens;" but as their numbers and the numbers of their cattle increased, they formed colonies in various directions, especially in "Wonne-squam-sauke," (now Essex county,) for amid its "pleasant waters" were unwooded meadows suitable for pasturage and for grass cutting, while the uplands were well adapted for tillage. Squatter sovereignty was unknown, for no individuals were permitted to establish themselves within the limits of the colony. Each body swarmed out in community, with a regular allotment of individual farms, based in extent upon the wealth of the settlers, and a great pasture, a peat meadow, a salt marsh, and fishing grounds held in common. These farms were so laid out that no house was over half a mile from the meeting-house, and it was with astonishing rapidity that agricultural communities sprang up like the fabled warriors of Cadmus into full-armed life. Like those mythological knights, they were armed with weapons, not for their own destruction, but for the defence of their liberties and their homes. From these small farming hamlets have grown up most of the towns and cities of our country, and from one of them afterwards went forth the alpha of colonization in the great west. In the log cabin of that agricultural era were first cultivated the true, though austere religion, the domestic virtues, the sturdy habits of frugal industry, the daring spirit, and the devoted love of liberty that have so advanced the

prosperity and the glory of this western continent. The acorns planted by our fathers have become stately trees, under whose umbrageous foliage thousands of their descendants and others, whom the grateful shade has invited from less favored lands, find protection, shelter, and repose.

The immigants were supplied with carts, chains, shovels, hoes, and rakes, but it was some years before a plough was introduced; and even so late as 1637, there were but thirty ploughs in Massachusetts. A yeoman in Salem that year made complaint that "he had not sufficient ground to maintain a plough" on his tract of three hundred acres, and he was allowed an addition of twenty acres to his original grant if he would "set up ploughing." The ploughs first used were the imported English wheel ploughs, but somewhat lighter although clumsy kinds were in time made by the village wheelwright and blacksmith. Then came what was long known as the Cary plough, with clumsy wrought-iron share, wooden landside and standard, and wooden mouldboard plated over with sheet-iron or tin, and with short, upright handles, requiring a strong man to guide it. The bar-share plough was another form still remembered by many for its rudely-fitted wooden mouldboard and coulter, and immense friction, from the rough iron bar which formed the landside.

Massachusetts was the first among the colonies to introduce the manufacture of scythes and other agricultural implements. In 1646 the general court granted to Joseph Jenckes, of Lynn, a native of Hammersmith, in England, and connected with the first iron works in that colony, the exclusive privilege for fourteen years "to make experience of his abillityes and inventions for making, among other things, of mills for the making of sithes and other edge tooles." His patent "for ye more speedy cutting of grass" was renewed for seven years in May, 1655. The improvement consisted in making the blade longer and thinner, and in strengthening it at the same time by welding a square bar of iron to the back, as in the modern scythe, thus materially improving upon the old English scythe then in use, which was short, thick and heavy, like a bush scythe. A century later a Scotchman named Hugh Orr came to Massachusetts and erected at Bridgewater the first trip hammer in the colony, with which he manufactured scythes, shovels, axes, hoes, and other implements, for which that place has since enjoyed a deserved reputation.

Thanks to the industrious antiquarians who have gleaned from manuscripts, traditions, and old publications almost every detail of the domestic life of the first settlers, we can constitute ourselves a "committee on farms," and in imagination visit one of the early yeomen. Riding along a "trail" indicated by marked trees, we find his horse and cattle shed standing near an old Indian clearing, encircled by a high palisade, which also includes the spring, that water may be brought without danger from the "bloody savages." The house, which is over a small deep cellar, is built of logs, notched where they meet at the corners, with a thatched roof, and a large chimney at one end built of stones cemented with clay. The small windows are covered with oiled paper, with protecting shutters, and the massive door is thick enough to be bullet-proof. Pulling the "latch string" we enter, and find that the floor, and the floor of the loft which forms the ceiling, are made of "rifted" or split pine, roughly smoothed with the adze, while the immense hearth, occupying nearly an entire side of the house, is of large flat stones. There are no partition walls, but thick serge curtains are so hung that at night they divide off the flock beds, upon which there are piles of rugs, coverlets, and flannel sheets. A high-backed chair or two, a massive table, a large chest with a carved front, and some Indian birch bark boxes for wearing apparel, are ranged around the walls, while on a large "dressior" we see wooden bowls and trenchers, earthen platters, horn drinking-cups, and a pewter tankard. The corselet, matchlock, and bandoliers are ready for defence, with a halberd, if the senior occupant of the house holds a commission in "ye train band," and from a "lean-to" shed comes the hum of the great wheel or the clang of the

loom as the busy "helpmates" hasten to finish their "stents." High on the mantel shelf, with a "cresset lamp" on one side and the time-marking hour-glass on the other, is the well-thumbed Bible, which was not left for show. "Our especial desire is," say the company's instructions, "that you take especial care in settling these families that the chief in the family be grounded in religion, whereby morning and evening family duties may be duly performed, and a watchful eye held over all in each family by one or more in each family appointed thereto, that so disorders may be prevented and ill weeds nipt before they take too great a head."

The fare of the Puritan farmers was as frugal as it was wholesome: Pease porridge for breakfast; bread, cheese, and beer or cider for luncheon; a "boiled dish," or "black broth," or salt fish, or broiled pork, or baked beans, for dinner; hasty pudding and milk for supper, and a constant succession of fruit or berry pies at every meal when the housewife had time to make them in addition to her other cooking, her dairy, washing, mending, carding, spinning, weaving, and knitting. Swedish turnips were the staple vegetable. The bread was generally made of corn, barley, or rye meal, and if the diet was rather farinaceous than animal, there was less demand for medicine, and a larger, longer-lived growth of men and women than in these degenerate days of luxury and "progress."

Success attended agricultural labor, and the farmers were aware of their dominant position—a position their numerical strength always enables them to maintain if they will. When, in 1633, the all-potent magistrates declared it "lawful for any man to kill any swine that comes into his corn," the yeomen raised their backs. A convention of two delegates from each town (the first convention that ever met on this continent) assembled and called for a sight of the royal charter. Examining it, they resolved that the right to make laws rested not with the magistrates, but with the freemen, nor did they cease their exertions until they established the law-making and money-raising power of the general court in 1634.

The sacred flame of Massachusetts freedom was thus fed by lard oil! It was probably some offending porker who had taken liberties with Governor Endicott's garden, or had damaged Mr. Winthrop's lawn with his insinuating snout, who thus became the germ of our popular institutions, and the parent of that august body which has so ungratefully adopted a codfish as its emblem!

At the first session of the "general court," (which only lasted three days,) the regulations respecting trespassing swine—the immediate cause of the late political change—were repealed, and this matter left to the several towns. It proved, however, an embarrassing subject, and was often afterward before the court. The next year (1635) the practice of impounding stray animals was introduced, much the same as exists at present. The year after a special officer, called a hog-reeve, was ordered to be elected in each town to look after those animals; but frequent changes afterward in the law upon this subject showed how difficult it was to reconcile the conflicting interests of the corn-growers and the pig-owners. A small matter this for history; but why smaller than other like conflicts of individual interest of which so much of our politics consists?

THE CAVALIER ENGLISH COLONIES.

The tide-water regions of Maryland and Virginia and the Carolinas were originally settled by the cavalier aristocracy of England, with their servants and their slaves. Next came the Scotch merchants and mechanics, a moral, industrious, and honest race, who located themselves in the towns. Afterward there was an immigration of French Huguenots of high character and attainments; and in later years, the unsuccessful rebellions of the elder and younger Pretenders forced large numbers of Scotch Jacobins to seek new homes on the western continent. Many indentured white servants, and some transported convicts, were also sent over from England; but after a generation or so all of these

became blended into a homogeneous race of "cavaliers;" aristocratic, because they had an inferior race beneath them.

An idea of the immigration by which Virginia, the mother of the South Atlantic States, was colonized, may be formed from the response of Governor Sir Wm. Berkley to one of the many interrogatories propounded to him by the British lords commissioners of foreign affairs, viz: "What number of English, Scotch, and Irish have for these seven years last past come yearly to plant and inhabit with your government; and also what blacks or slaves have been brought in within the same?" "Yearly there comes in of servants about fifteen hundred; most are English, few Scotch, and fewer Irish, and not above two or three ships of negroes in seven years!" He says nothing of the free emigrants, though included in the interrogatory, and their number was doubtless too inconsiderable for notice. In the same examination, Sir William says: "But I thank God there are no free schools or printing, for learning has brought disobedience and heresy and sects into the world, and printing has divulged them and libels against the best government. God keep us from both!"

The feudal system was transplanted to Virginia, and the royal grants of land gave the proprietors baronial power. One of these grants, or "patents," as they were called, gave the patentee the right "to divide the said tract or territory of land into counties, hundreds, parishes, tithings, townships, hamlets, and boroughs; and to erect and build cities, towns, parish churches, colleges, chapels, free schools, almshouses, and houses of correction, and to endow the same at their free will and pleasure, and did appoint them full and perpetual patrons of all such churches so to be built and endowed; with power also to divide any part or parcel of said tract or territory, or portion of land, into manors, and to call the same after their own or any of their names, or by other name or names whatsoever; and within the same to hold a court in the nature of a court baron, and to hold pleas of all actions, trespasses, covenants, accounts, contracts, detinues, debts, and demands whatsoever, when the debt or thing demanded exceed not the value of forty shillings, sterling money of England; and to receive and take all amercements, fruits, commodities, advantages, perquisites, and emoluments whatsoever, to such respective court barons belonging or in any wise appertaining; and further, to hold within the same manors a court leet and view of frank pledge of all the tenants, residents, and inhabitants of the hundred within such respective manors," &c., &c.

The Maryland and Virginia estates were large, extending far back in the country from their fronts on the Chesapeake bay or its tributaries, near which the buildings were located. Tide-water was at every cavalier planter's door, and ships from England brought him his annual supplies of merchandise in exchange for his crop of tobacco, while smaller crafts came with the products of the New England fisheries and of the West India plantations, to barter for his tobacco, cotton, wheat, or corn. The neighboring waters swarmed with many varieties of wild fowl, and abounded with fish, oysters, soft crabs, and turtle, while in the woods was an abundance of game.

The mansion houses, each of which had its name, were invariably erected on high ground, often half a mile from the water's edge. This intervening space was generally laid out as a garden in the prim style of those days, with terraces and arbors, and large box borders to the geometrically shaped parterres. Nearly all of the houses were built of hard English brick; and the iron-work, with much of the wood-work, was also imported. Entering the hall—so we are told by a Virginia antiquarian—one saw walls covered with deer's antlers, fishing rods, and guns, portraits of cavaliers and dames and children; even carefully painted pictures of celebrated race-horses, on whose speed and bottom many thousands of pounds had been staked and lost and won in their day and generation. On one side of the hall a broad staircase with oaken balustrade led to the numerous apartments above; and on the opposite side, a door gave entrance

into the great dining-hall. The dining-room was decorated with great elegance; the carved oak wainscot extending above the mantelpiece in an unbroken expanse of fruits and flowers, hideous laughing faces and armorial devices to the cornice. The furniture was in the Louis Quatorze style, with carved backs to the low-seated chairs. There were Chelsea figures, and a sideboard full of plate, and a Japan cabinet, and a Kidderminster carpet, while in the great fireplace a few twigs crackled on huge and highly-polished brass andirons. On the walls hung pictures of gay gallants, brave warriors, and fair dames whose eyes outshone their diamonds; and more than one ancestor looked grimly down, clad in cuirass and armlets, and holding in his mailed hand the sword which had done bloody service in its time. The lady portraits, as an invariable rule, were decorated with sunset clouds of yellow lace; the bright locks were powdered, and many little black patches set off the dazzling fairness of the rounded chins.

Near the mansion were tenements for the manager and the overseers, and comfortless cabins for the slaves. It is said by a distinguished Virginia writer, that Colonel John Taylor, of the Rappahannock valley, equally distinguished in the account of the past century as a farmer, an author, and as a statesman, was the first to ameliorate the condition of his slaves. "He built commodious brick dwellings for them, and accustomed them to plank floors, glass windows, and decent, civilized habits of living. He, besides, furnished them more regularly and abundantly with food and clothing than was then usual. His negroes multiplied rapidly, became more honest and industrious, and his crops increased."

There was yet another class of Virginia colonists—the pioneers—who contrasted strongly with the cavalier planters and their adherents. Generally speaking, they were younger sons, unlucky gamesters, turbulent spirits, rejected lovers or disbanded soldiers, who turned their backs upon civilization to live an untrammelled life in some fertile mountain gap or rich river bottom. Game was plentiful, and they were hunters rather than farmers, sending their peltries to market, and only cultivating enough land to supply their wants. This unrestrained life became a passion, and as the tide of civilization advanced westward, the pioneers would leave their "settlements" with their "improvements," to seek some spot in the wilderness where as yet no white man's foot had trodden.

Tobacco became the staple product of Virginia soon after the first settlement of the British colonists, and although many and stringent laws were enacted to prevent its cultivation, little attention was paid to any other crops beyond what was needed for home consumption. Attempts were made to encourage other branches of rural industry. But the Virginia land owners preferred the exhausting tobacco plants, with a continuous cropping, shallow ploughing, and no supplies of fertilizers, until every particle of nourishment had been drawn from the soil by the plants, or washed out by the rains. The implements used were small ploughs and heavy hoes; and when the tobacco had been gathered, cured and packed into hogsheads, these were rolled to the nearest inspection wharf. The roads were bad, and there were but few wagons, so a pole and whiffletrees were attached to each hogshead by an iron bolt driven in the centre of each head, and it was converted into a large roller. For many years the places for deposit and inspection of tobacco on the river were called "rolling houses."

King James the First, prompted doubtless by his antipathy to "the Virginia weed," and "having understood that the soil naturally yieldeth store of excellent mulberries," gave instructions to the Earl of Southampton to urge the cultivation of silk in the colony, in preference to tobacco, "which brings with it many disorders and inconveniences." In obedience to the command, the earl wrote an express letter on the subject to the governor and council, in which he desired them to compel the colonists to plant mulberry trees, and also vines. Accordingly, "as early as the year 1623, the colonial assembly directed the planting of mulberry trees; and in 1656 another act was passed, in which the culture of silk is described as the most profitable commodity for the country, and a penalty

or ten pounds of tobacco is imposed upon every planter who shall fail to plant at least ten mulberry trees for every hundred acres of land in his possession. In the same year a premium of 4,000 pounds of tobacco was given to a person as an inducement to remain in the country and prosecute the trade in silk; and in the next year a premium of 10,000 pounds of tobacco was offered to any one who should export £200 worth of the raw material of silk." About the same time, 5,000 pounds of the same article was promised "to any one who should produce 1,000 pounds of wound silk in one year."

The act of 1656, coercing the planting of the mulberry trees, was repealed in the year 1658, but was renewed two years after; and the system of rewards and penalties was steadily pursued until the year 1666, when it was determined that all statutory provisions were thereafter unnecessary, as the success of divers persons in the growth of silk, and other manufactures, "evidently demonstrated how beneficial the same would prove." Three years after, legislative encouragements were revived; but subsequently to the year 1669, the interference of government seems entirely to have ceased. The renewal of the premiums after the act of the year 1658 was, doubtless, upon the recommendation of Charles II; for, in the year 1661, among the instructions given to Sir William Berkeley, upon his reappointment as governor, and while in England on a visit, the king recommended the cultivation of silk, and mentioned, as an inducement to the colonists to attend to his advice, "that he had formerly worn some of the silk of Virginia, which he found not inferior to that raised in other countries." This remark is probably the ground of the tradition mentioned by Beverly, that the king had worn a robe of Virginia silk at his coronation. The revived encouragement given by the colonial legislature to the culture of silk had the desired effect. Mulberry trees were generally planted, and the rearing of silk-worms formed a part of the regular business of many of the farmers. Major Walker, a member of the legislature, produced satisfactory evidence of his having 70,000 trees growing in the year 1664, and claimed the premium. Other claims of a like tenor were presented the same session.

Upon the settlement of Georgia, in 1732, the culture of silk was also contemplated as a principal object of attention, and lands were granted to settlers on condition that they planted one hundred white mulberry trees on every ten acres when cleared; and ten years were allowed for their cultivation. Trees, seeds, and the eggs of silk-worms were sent over by the trustees, to whom the management of the colony was intrusted. An Episcopal clergyman and a native of Piedmont were engaged to instruct the people in the art of rearing the worms and winding the silk; and in order to keep alive the idea of the silk culture, and of the views of the government respecting it, on one side of the public seal was a representation of silk-worms in their various stages, with this appropriate motto, "*Non sibi sed aliis.*" By a manuscript volume containing "the account of the money and effects received and expended by the trustees of Georgia," it appears that the first parcel of silk received by the trustees was in the year 1735, when eight pounds of raw silk were exported from Savannah to England. It was made into a piece, and presented to the queen.

From this time until the year 1750 there are entries of large parcels of raw silk received from Georgia, the produce of cocoons raised by the inhabitants, and brought from there, at established prices, by the agents of the trustees, who had it reeled off under their direction. In the year 1751, a public filature was erected by order of the trustees. "The exports of silk from the year 1750 to 1754, inclusive, amounted to $8,880. In the year 1757, one thousand and fifty pounds of raw silk was received at the filature. In the year 1758 this building was consumed by fire, with a quantity of silk and 7,040 pounds cocoons; but another was erected. In the year 1759 the colony exported upwards of 10,000 weight of raw silk, which sold two or three shillings higher per pound than that of any other country." According to an official statement of William Brown,

comptroller of the customs to Savannah, 8,829 pounds of raw silk were exported between the years 1755 and 1772, inclusive. The last parcel brought for sale to Savannah was in the year 1790, when upwards of two hundred weight were purchased for exportation, at 18*s.* and 26*s.* per pound.

Some attention was also paid, in early times, to the culture of silk in South Carolina; and the writer has been informed that, during a certain period, it was a fashionable occupation. The ladies sent the raw silk produced by them to England, and had it manufactured. "In the year 1755, Mrs. Pinckney, the same lady who, about ten years before, had introduced the indigo plant into South Carolina, took with her to England a quantity of excellent silk which she had raised and spun in the vicinity of Charleston, sufficient to make three complete dresses; one of them was presented to the Princess Dowager of Wales, and another to Lord Chesterfield. They were allowed to be equal to any silk ever imported. The third dress—given to her daughter, Mrs. Harry—was remarkable for its beauty, firmness, and strength." The quantity of raw silk exported was small; for, during six years, only 251 pounds were entered at the custom-house. The quality of it was excellent; according to the certificate of Sir Thomas Lambe, the eminent silk manufacturer, it had as much strength and beauty as the silk of Italy. At New Bordeaux, a French settlement, seventy miles above Augusta, the people supplied much of the high country with sewing silk during the war of the Revolution.

The culture of silk in the American colonies of Great Britain was especially promoted by the London Society for the Encouragement of Arts, Commerce, and Manufactures. The first premiums offered were in 1755; "ten pounds to the person who shall plant and properly fence the greatest number of white mulberry trees on his own plantation, five pounds to the second greatest number, and three pounds for the third greatest number." These premiums were awarded, and the next year they were offered for Carolina as well as for Georgia.

In 1757, a premium for the silk itself was substituted in the place of that for mulberry trees, and advertised in the following manner: "The production of silk in our American colonies being undoubtedly a proper object of encouragement, as it must tend greatly to the advantage of those colonies, and prove highly beneficial to the mother country, by promoting a very valuable branch of its manufactures, in order to forward the same, by such bounties as may operate, in equal proportion, to the benefit of the poorest as well as the richest planter, the society propose to give, for every pound weight of cocoons produced in the province of Georgia, in the year 1757, of a hard, weighty, and good substance, wherein one worm has only spun, three pence; for every pound of cocoons, produced in the same year, of a weaker, lighter, spotted or bruised quality, though one worm has only spun in them, two pence; for every pound of cocoons, produced in the same year, wherein two worms have interwoven themselves, one penny." These premiums were again offered in 1758, for the provinces of Georgia, Connecticut and Pennsylvania.

In 1759 the same premiums were offered for Georgia, and "for every pound weight of merchantable raw silk raised and produced in the colonies of Connecticut, Pennsylvania, and North Carolina, in the year 1760, two shillings and sixpence." And, "Whereas, the object and intention of the society, in giving the above mentioned premiums, were to encourage, as far as in them lay, the importation into this country [England] from our colonies of this valuable material of manufacture, which was there imported, at a great expense, from foreign nations: in order to promote that end, for the mutual benefit of the mother country and the colonies, the society agree to give a further premium of one shilling for every pound of raw silk imported into England from the said colonies of Connecticut, Pennsylvania, and North Carolina." All these premiums were continued to be advertised to the year 1762. Another additional one was then resolved upon for this article. It was, "For the greatest quantity of good merchantable raw silk,

not less than one hundred pounds weight, produced in any of the British American colonies, and imported into the port of London, one hundred pounds; but Georgia, South Carolina, North Carolina, Connecticut, and Pennsylvania are excepted, those colonies having a particular premium. For the next greatest quantity, not less than fifty pounds weight, fifty pounds."

Cotton, which is the staple of the southern States settled by Virginians, was first grown by the early colonists in 1621, but it was not an article of general home consumption or of export for many years. In 1748 seven bags of cotton-wool, valued at £3 11*s.* 5*d.* a bag, were among the exports of Charleston, South Carolina; and after the Revolution the growth and exportation of the sea island cotton was commenced, seed having been obtained from one of the leeward isles. Originally the cotton was separated from the seed with the fingers, and afterwards there were several contrivances used, among them the employment of a long bow fitted with a number of strings, which, being vibrated by the blows of a wooden mallet while in contact with a bunch of cotton, shook the seed and dust from the mass. In 1742 M. Dubreuil, a wealthy planter of New Orleans, invented a cleaning-machine, which was so far successful as to give quite an impulse to the cotton culture in Louisiana, and several other inventions were subsequently used in other sections of the south, but none of them accomplished the desired work. In 1794, Eli Whitney, a native of Massachusetts, then residing in Georgia, discovered the saw-gin, which completely removes all extraneous matters without injury to the fibre, and enables a man to clean three hundred pounds a day instead of one pound, as he had been able to do by hand. This wonderful labor-saving machine has exerted an influence on the industrial interests of the world, and has placed cotton foremost among our national exports.

The production of wine in the Atlantic colonies was believed to be practicable by many of the early settlers, and several of the governors endeavored to encourage the planting of vineyards. In 1758, the London Society for the Encouragement of Arts, Commerce, and Manufactures proposed the following premium for the wine itself: "As producing wines in our American colonies will be of great advantage to those colonies, and also to this kingdom, it is proposed to give to that planter, in any of our said colonies, who shall first produce, within seven years from the date hereof, from his own plantation, five tons of white or red wine, made of grapes, the produce of these colonies only, and such as, in the opinion of competent judges, appointed by the society in London, shall be deemed deserving the reward—not less than one ton thereof to be imported at London—one hundred pounds." This premium was continued to be advertised to 1765, the period appointed for bringing in the claims, and then dropped. After the year 1759, a *nota bene* was added to the advertisement, which expressed, "that the method of cultivating vines for wines and the manner of making wines in different countries were to be found in *Miller's Dictionary*, edit. 1758."

In 1762 the society announced: "A premium of two hundred pounds will be given for the greatest number, not less than five hundred, of the plants of the vines which produce those sorts of wines now consumed in Great Britain, which shall have been properly planted, and effectually fenced, secured, and cultivated within any of the British colonies upon the continent of North America, to the northward of the river Delaware, considered as one district, between the 1st of April, 1762, and the 1st of April, 1767; and fifty pounds for the next greatest quantity, not less than one hundred plants." Similar premiums were offered "for any of the British colonies on the continent of North America to the southward of the river Delaware." In 1763, the society thought proper to continue the premiums for planting vines in the colonies to the southward of the river Delaware, and the Bermuda islands, to the year 1768. In 1765, they also proposed to give additional premiums of two hundred pounds, and fifty pounds, under the like limitations, for planting the same quantity of vines, actually producing the grapes, which yield those sorts of wines now consumed in Great Britain, between

the 1st of April, 1768, and the 1st of March, 1770. These they extended to the three several districts, as in the former premium of 1762. After that date, no premiums for either vineyards or vines were offered.

The memoirs of the society, published in 1769, say: "The first account of the success of the premiums for wines was in 1763, when Mr. Carter sent a dozen bottles of two kinds of wine, from grapes which grew in vineyards of his own planting in Virginia. The one of these kinds was the product of vines brought from Europe; the other of the American wild vines. They were both approved as good wines; and the society gave their gold medal to Mr. Carter, as the first who had made a spirited attempt towards the accomplishment of their views respecting wine in America. In 1767, there were claims made for the premiums on planting vines, both from the districts to the southward and northward of the river Delaware. But the form of certification of that to the southward not being conformable to the advertisement, the claim was not allowed. There were two claims for that of the northward; but the claimant who had planted the greatest number of vines having also failed in some essential points of certification, the premium was adjudged to the other. However, in consideration of his having planted so great a number of vines as two thousand one hundred, the society thought fit to give him a gold medal. The society, therefore, at the expense of two hundred pounds, and two gold medals, besides what they may pay on account of others, have fully succeeded in their attempts to introduce the cultivation of the European vines into America."

The London Society for the Encouragement of Arts, Sciences, and Manufactures also offered premiums for hemp, opium, olives, pot and pearl ashes, barilla, logwood, scammony, (produced from the *Convolvulus Scammonia*,) myrtle wax, (produced from the candleberry myrtle,) sarsaparilla root, and gum from the persimmon tree. It was thought that this gum might take the place of gum-arabic, and directions were given for gathering, but it was ascertained that the cost would be three shillings sterling a pound, and as gum-arabic could be bought at London for less than one-sixth of that price, the premiums were discontinued after having been offered for three years.

The British Parliament granted considerable sums of money, at different times, to encourage the growth of silk, indigo, and other agricultural crops. At the same time, the North American colonists were obliged to send all their domestic products to England, and they were not allowed to purchase the manufactures of any foreign country unless they came through a British port.

THE FRENCH COLONISTS.

While the tide-water region of the Atlantic coast was being colonized, from the Penobscot to the Altamaha, by the British, by the Dutch, and by the Swedes, the French ascended the St. Lawrence and the great lakes, crossed to the head-waters of the Mississippi, and descended that river to its mouth. They were explorers, not settlers, and when they established posts it was for hunting, rather than agriculture. Their leaders, stamped with martial virtues and martial faults, ambitiously endeavored to grasp the entire western continent rather than to cultivate a portion of it, and the historian's account of their adventures is a romance. Plumed helmets gleamed in the shade of the forests which bordered the lakes and rivers of what was then the far west, and priestly vestments were to be seen around the fitful light of the camp-fires. Men of courtly nurture, heirs to the polish of a far-reaching ancestry, established their "seignories" here and there, but paid little attention to the cultivation of the soil.

Louisiana was the only French colony in which especial attention was paid to agricultural pursuits. A variety of crops were tried, successively, but none proved as remunerative as the sugar-cane, which had been taken from India to Spain by the Saracens, thence to Madeira, and thence to the West India islands.

PLATE XXXVI.

SUGAR-MAKING IN LOUISIANA IN 1751.

In 1751, a French transport, having on board two hundred troops for the garrison of the colony of Louisiana, touched at St. Domingo. The Jesuits located in the bay of Port-au-Prince, obtained leave to send on board, for their branch establishment at New Orleans, a supply of cane, with a few negroes used to its cultivation and the manufacture of sugar. These canes were landed and planted, but for several years the Jesuits, and those to whom they gave canes, were equally unsuccessful either in their cultivation or in the manufacture of sugar.

A quaint engraving, executed in Germany, represents the process of manufacture. The cane was stripped of its leaves and ground, or rather crushed, by a heavy stone made to revolve by manual force. The expressed juice, after having been boiled in a cauldron, was ladled into large stone jars, which were exposed to the rays of the sun until the sugar crystallized. The engraving so fully illustrates the process that it has been reproduced for this volume.

In 1764 the Chevalier De Mazan tried the experiment on his plantation, on the opposite shore of the Mississippi river, with more success. In the following year Destrehan (then treasurer of the King of France in the colony) and several other planters put up works below the city, on the left bank, but with the same result. The planters were disheartened, and in 1769 the manufacture of sugar in Louisiana was entirely abandoned, and the planters turned their attention to the cultivation of indigo, cotton, tobacco, rice, corn, &c. A few small gardeners continued the planting of sugar-cane in the neighborhood of the city, which they retailed in the market for the use of children, or expressed the juice, making sirup, which they sold in bottles. More than twenty-five years elapsed before further efforts were made in its cultivation.

In 1791 A. Mendez, of New Orleans, purchased the apparatus, land, &c., which now forms a part of the Oluren plantation, at Terre aux Bœufs, below the city, and, nothing daunted, resolved to carry on the manufacture of sugar. He secured the services of M. Morie, who had gained some experience in the manufacture at St. Domingo. He was more successful; and at a grand dinner with Don Reindin, (then Spanish Intendant of Louisiana,) given to the public authorities of New Orleans, he exhibited as a curiosity a few small loaves of refined sugar, the first ever produced in Louisiana.

In 1792 Etienne Bord, a planter living a few miles above the city, finding his indigo crops a failure, determined, as a dernier resort, to try the cultivation of sugar. At length, in 1795, his success was partial, and in the following year, under the auspices of Morie, it was rendered complete. He was induced to make further improvements and essay new experiments, until he fully established this, one of the most productive branches in Louisiana.

At that time there were but two varieties of cane in Louisiana—the Malabar or Bengal, and the Otaheite; these have disappeared, or nearly so, and have given place to the purple or red-ribbon cane of Java or Batavia. The Dutch introduced it, about the middle of the last century, to St. Eustatius, Curaçoa, Guiana, and Surinam, whence it spread all over the West Indies and over a portion of the South American continent.

In 1814 an American schooner imported a few bundles of this cane into Georgia, and in 1817 about a dozen of these plants were brought to New Orleans by John Joseph Coiron, who planted them in his garden at Terre aux Bœufs. Meeting with the most gratifying success in their cultivation, Mr. Coiron, in 1825, imported a sloop load from Savannah, which he planted on his estate, known as the St. Sophie plantation, about thirty-six miles below the city. Thence originated the ribbon-cane, or Javanese, now most generally grown throughout Louisiana and Texas.

The French were the first to collect agricultural statistics on this continent. The governors of Canada and of Louisiana, from the year 1689 until the termination of the French rule in those colonies, obtained every year the number of acres cultivated, the amount of crops raised, the number of horses, cows, sheep, and swine, and the success which attended the cultivation of new crops introduced

by order of the home government. These interesting agricultural statistics, with the exception of a few missing years, are now in the archives of France.

THE REVOLUTIONARY PERIOD.

The American colonists not only subdued the wilderness, but conquered its savage occupants and carried on expensive wars, fighting bravely at Quebec and at Louisbourg, at Ticonderoga and at Fort Duquesne. As they advanced in civilization attempts were made to improve their cultivation of the soil, being stimulated by the premiums offered in England. In 1747 Jared Elliot, a Connecticut clergyman, published a useful work on field husbandry, and the invoices of the London tobacco factors show that there was a demand for the works of Jethro Tull by the Virginia planters.

When Dr. Franklin went to England, as the agent of Pennsylvania, he was not unmindful of its greatest interest, and he sent home for distribution, in 1770, seeds, mulberry cuttings, silkworms' eggs, &c., thus initiating that system of government supply which has been productive of such important results.

The glorious aid given by the planters and farmers in the revolutionary struggle of 1776 forms a bright chapter in the annals of American agriculture. Had we had many large cities then, as now, it is doubtful if independence would have been declared, for we should have been so accessible to attack that it would have been madness to have commenced that "resistance to tyrants" which is "obedience to God." As it was, tories abounded in the cities, each of which was in turn occupied by the red-coats; and all must admit that British power was prostrated on this continent by the hard-handed operatives of iron nerve, a majority of them yeomen, who left their ploughs in the furrows to aid the farmer of Mount Vernon in unyoking their land from tyranny. In recalling the patriotic devotion of our forefathers, which has since been imitated again and again when the war trumpet has been heard in the land, let us bear in mind that when Rome—that victorious imperial mother of nations—suffered her noble urban citizens to "crush out" the cultivators by unjust taxation and the free admission of agricultural products, her power began to wane. Long before the race of the patricians had become extinct, the free cultivators had disappeared from the fields, leaving no recruits for the once victorious cohorts, who now fled before the invading Goths. Truly Goldsmith said—

> "Princes or kings may flourish or may fade,
> A breath can make them as a breath has made;
> But a bold yeomanry, their country's pride,
> When once destroyed can never be supplied."

General Washington, while "first in war," never "virtually ceased," we are told by Irving, "to be the agriculturist. Throughout all his campaigns he had kept himself informed of the course of rural affairs at Mount Vernon. By means of maps, on which every field was laid down and numbered, he was enabled to give directions for their several cultivation, and receive account of their several crops. No hurry of affairs prevented a correspondence with his overseer or agent, and he exacted weekly reports. Thus his rural were interwoven with his military cares; the agriculturist was mingled with the soldier; and those strong sympathies with the honest cultivators of the soil, and that paternal care of their interests, to be noted throughout his military career, may be ascribed, in a great measure, to the sweetening influence of Mount Vernon."

The deplorable condition of the agriculture of the republic was not unnoticed by the "fathers of the country." Washington commenced making experiments on his farm at Mount Vernon, and John Adams on his farm at Quincy, and Jefferson on his estate at Monticello. Many of the reverend clergy made their parsonage farms and glebe lands models to the counties round, and there was a great demand for agricultural literature. Mr. Jefferson also exercised his me-

chanical tastes in improving the mouldboard of ploughs, which he afterwards adapted to an improved plough sent him by the agricultural society of the department of the Seine, in France. His son-in-law, Mr. Randolph, whom Mr. Jefferson thought the best farmer in Virginia, invented a side-hill plough, adapted to the hilly regions of that State, and designed to turn horizontally in the same direction the sides of steep hills, which, in northern Europe, was effected by a shifting mouldboard, constituting the variety called turn-wrest ploughs. Colonel Randolph's plough was made with two wings welded to the same bar, with their planes at right angles to each other, so that by turning the bar adjusted to an axis either wing could be laid flat on the ground, while the other, standing vertically, served as a mouldboard. Mr. Jefferson advocated an adherence to scientific principles in the construction of the plough. Perhaps the first attempt to carry out these suggestions was made by Robert Smith, of Pennsylvania, who took out the first patent for the mouldboard alone of a plough. It was of cast-iron, and became the foundation of many hundred improvements of later date.

Peace spread her wings over the new-born republic, and her soldiers, like Cincinnatus, returned to their farms. But while their Spartan-like virtues and domestic manners were worthy of high commendation, little can be said in praise of their system of agriculture. Buildings, stock, implements, and tools were alike inferior, and there were obstacles and prejudices against an "innovation" in the established routine of practice. The meadows were left undrained, and the exhausted uplands bore but scanty crops, and were abandoned to weeds under the mistaken idea of fallow-rests. Farmers were obliged to leave their worn-out soil and seek new fields in the uncleared forests, and it has been well said that even the most successful cultivators knew as little of the chemistry of agriculture as of the problems of astronomy. The farmer who ventured to make experiments, to strike out new paths of practice, or to adopt new modes of culture, subjected himself to the ridicule of a whole neighborhood. For many years, therefore, the same routine of farm labor had been pursued in the older settlements, the son planting just as many acres of corn as his father did "in the old of the moon," using the same number of oxen to plough, and getting in his crops on the same day, after having hoed them the same number of times as his father and grandfather did. The rotation of crops was almost unknown; the value of manures was little regarded; labor-saving implements were never thought of, and the undersized horses, cattle, and sheep were so badly cared for during the winter that they cast but faint shadows in the spring.

The Spanish government, which then exercised jurisdiction over Louisiana and Arkansas, aided several attempts to form colonies there, which would supply her West India islands with flour, and her naval ropewalks with hemp. Transportation, lands, provisions, and seed were bountifully supplied, and the pre-emptive system was thus inaugurated in the great Mississippi valley. The Congress of the United States soon afterwards began to enact laws for the benefit of settlers, which have enabled hundreds of thousands to obtain rural homes, and to thus develop the agricultural resources of our fertile prairies and forests.

AGRICULTURAL SOCIETIES.

In 1785 a "Society for promoting agriculture" was formed in Philadelphia by professional gentlemen, merchants, and a few owners of farms, who were convinced of the necessity for agricultural improvement. Similar associations were soon afterwards formed at Charleston, South Carolina, in the city of New York, and in Boston, Massachusetts, all of which advanced the interests of agriculture in their neighborhood. At first these societies were ridiculed by the practical farmers; but it was soon discovered that their transactions contained much valuable information. The great improvers of agriculture—and the remark is not peculiar to this pursuit—have been for the most part those who have brought

to bear on it the analogies and perceptions derived from other arts; a class of men of whom Middleton remarks "that they form the most intelligent and accurate of husbandmen. Like converts in religion, they have more zeal and fewer prejudices to surmount than those who have been brought up in it from their infancy. Their indefatigable attention makes more than amends for their ignorance of minutiæ; and having been at the pains to acquire a knowledge of the theory of their new pursuit, they establish their ideas on rational principles."

On the 4th of July, 1785, General Washington was elected an honorary member of the Philadelphia Society for the Promotion of Agriculture, recently established at what was then the seat of government, in the proceedings of which he always afterwards expressed a deep interest. Agriculture was a favorite topic in his voluminous correspondence; and among those from whom he sought rural information were Arthur Young and Sir John Sinclair, of England. A perusal of the proceedings of the British Board of Agriculture, founded by Sir John Sinclair, evidently inspired General Washington with a desire to see a similar institution established in the United States, although he was aware, from the opposition manifested against all new or federal measures, that it might not be popular. In reply to a suggestive inquiry made by Sir John Sinclair, General Washington wrote, on the 20th of July, 1794: "It will be some time, I fear, before an agricultural society, with congressional aid, will be established in this country. We must walk, as other countries have, before we can run. Smaller societies must prepare the way for greater; but with the lights before us, I hope we shall not be so slow in maturation as older nations have been. An attempt, as you will perceive by the enclosed outlines of a plan, is making to establish a State society in Pennsylvania for agricultural improvements. If it succeeds, it will be a step in the ladder; at present it is too much in embryo to decide upon a result." In a letter to the same distinguished agriculturist, dated July 10, 1795, General Washington wrote: "From the first intimation you were pleased to give me of this institution, I conceived the most favorable ideas of its utility, and the more I have seen and reflected upon the plan since, the more convinced I am of its importance in a national point of view, not only to your own country, but to all others which are not too much attached to old and bad habits to forsake them, and to new countries that are just beginning to form systems for the improvement of their husbandry."

In September, 1786, Sir John Sinclair again urged upon his illustrious correspondent the establishment of a central agricultural association. "The people of this country," he wrote, "as well as of America, learn, with infinite regret, that you propose resigning your situation as President of the United States. I shall not enter into the discussion of a question of which I am incompetent to judge; but if it be so, I hope that you will recommend some agricultural establishment on a great scale before you quit the reins of government. By that I mean a board of agriculture, or some similar institution, at Philadelphia, with societies of agriculture in the capital of each State to correspond with it. Such an establishment would soon enable the farmers of America to acquire agricultural knowledge, and, what is of equal importance, afford them the means of communicating what they have learnt to their countrymen."

This suggestion was warmly seconded by Colonel Timothy Pickering, of Massachusetts, then Secretary of State, who had, during a temporary residence in Pennsylvania, been elected the first secretary of the Philadelphia Society for the Promotion of Agriculture, and who was a zealous advocate of concert of action among agriculturists. The "Farewell Address" had been published. In the President's speech, delivered on the 7th of December, 1796, when Washington met the two houses of Congress for the last time, he said: "It will not be doubted that, with reference to either individual or national welfare, agriculture is of primary importance. In proportion as nations advance in population and

other circumstances of maturity, this truth becomes more apparent, and renders the cultivation of the soil more and more an object of public patronage. Institutions for promoting it grow up supported by the public purse, and to what object can it be dedicated with greater propriety? Among the means which have been employed to this end, none have been attended with greater success than the establishment of boards composed of proper characters, charged with collecting and diffusing information, and enabled, by premiums and small pecuniary aids, to encourage and assist a spirit of discovery and improvement. This species of establishment contributes doubly to the increase of improvement by stimulating to enterprise and experiment, and by drawing to a common centre the results, everywhere, of individual skill and observation, and spreading them thence over the whole nation. Experience, accordingly, has shown that they are very cheap instruments of immense national benefits."

A few days afterwards, on the 10th of December, General Washington acknowledged the receipt of the letter from Sir John Sinclair, containing the suggestion above quoted, and stated that the rapidly closing scenes of his political life left him but little time to devote to agricultural matters. "I did not, however, (he wrote,) omit the occasion at the opening of the session to call the attention of that body to the importance of agriculture. What will be the result, I know not at present; but if it should be favorable, the hints which you will have it in your power to give cannot fail of being gratefully received by the members who may constitute the board."

That General Washington took a deep interest in the adoption of his recommendation, and that he was anxious to enlist prominent agriculturists, as well as Congress, in carrying out his plan, is shown by the following letter addressed by him to Judge Peters, who had a *fac simile* of it appended to the second volume of the Transactions of the Philadelphia Society for the Promotion of Agriculture:

"DEAR SIR: Herewith you will not only receive the outlines, &c., (asked for yesterday,) but the appendix thereto, and other productions from the same quarter, which, when you have done with, be so good as to return.

"These, or some of the papers, may be of use to a committee if Congress should incline to take up the subject of agriculture.

"Your observations, with the return of the papers, will be very acceptable to, dear sir, your obedient and affectionate,

"G. WASHINGTON.

"10th DECEMBER, 1796.

(Superscribed,) "RICHARD PETERS, Esq."

The Senate, in an address in answer to the President's speech, drawn up by Senator Read, of South Carolina, and adopted after having been amended, said: "The necessity of accelerating the establishment of certain useful manufactures by the intervention of the legislative aid and protection, and the encouragement due to agriculture by the creation of boards (composed of intelligent individuals) to patronize this primary pursuit of society, are subjects which will readily engage our most serious attention."

The House of Representatives referred the subject to a committee, (composed of Messrs. Swift, of Connecticut; Gregg, of Pennsylvania, and Brent, of Maryland,) which made a report on the 11th of January, recommending the institution of a society for that purpose under the patronage of the government, which might act as a common centre to all other societies of a similar kind throughout the United States. The report was accompanied by a plan, the principal articles of which were that a society shall be established at the seat of government; that it shall comprehend the legislature of the United States, the judges, the Secretary of State, the Secretary of the Treasury, the Secretary of War, the Attorney General, and such other persons as may choose to become members, according to the rules prescribed; that an annual meeting shall be held at the

seat of government, at which are to be elected the president, secretary, &c., and a board, to consist of not more than thirty persons, which shall be called the "board of agriculture;" that the society shall be a body corporate; that a report shall be made annually, &c. The report concluded with a resolution in these words: "*Resolved*, That a society for the promotion of agriculture ought to be established at the seat of government of the United States."

The report was twice read and ordered to be referred to a committee of the whole on the following Monday. But no action was taken. On that day, during a prolonged debate as to the necessity for direct taxation, there was a conflict of opinion between the representatives of commercial and of agricultural constituencies, which, perhaps, made the friends of the resolution fearful that it would, if pressed to a vote, be defeated. Besides, it was associated with a recommendation for a military academy, which Mr. Jefferson had openly opposed, on the ground that "none of the specific powers given by the Constitution to Congress would authorize it." Colonel John Taylor of Caroline, in one of his admirable essays, signed "Arator," censured Congress for their action in recommending a society which he called a "toy for its amusement," and said: "This toy was found to be unconstitutional because it would add but little to the power of the general government, and the infant was turned to graze in impoverished fields. The Constitution was *construed* to exclude Congress from the power of fostering agriculture by patents or bounties, and to give it the power of fostering banks and manufactures by patents and bounties."

General Washington, three days after the termination of his presidential career, and when about to return to rural life at Mount Vernon, the "haven of his hopes," wrote to Sir John Sinclair: "I am sorry to add that nothing *final* in Congress has been decided respecting the establishment of a national board of agriculture recommended by me at the opening of the session. But this did not, I believe, proceed from any disinclination to the measure, but from their limited sitting and a pressure of what they conceived more important business. I think it highly probable that next session will bring the matter to maturity."

These brief extracts show clearly the desire of the "Father of his Country" to see a central agricultural organization established under the fostering care of the federal government, and they call for a conspicuous record on the monument now being erected to his memory, that "the encouragement of agricultural improvement and information was among the favorite wishes of his heart."

ESTABLISHMENT OF AGRICULTURAL FAIRS.

At the commencement of the present century there was a general disposition manifested to encourage agriculture, and to use broadcloths, silks, kerseys, and nankeen cotton goods of home growth and manufacture. In 1804 it was suggested by Dr. Thornton, the first Commissioner of Patents, then residing in Washington, which was literally a "city in the woods," that the ready sale of cattle and of domestic products could be promoted by the holding of fairs or market days, as in England, his native land. The idea met with the warm approval of the citizens, and the municipal authorities passed an act establishing semi-annual fairs. An editorial article in the National Intelligencer, of October 17, spoke of the coming fair as offering advantages to purchasers and to settlers, "while at the same time it can but prove equally beneficial to the agricultural interests of our country."

The fair was held on Wednesday, Thursday, and Friday, on "the mall at the south side of the Tiber, extending from the bridge at the Centre market to the Potomac." "It was a decided success," and before the next one was held an attempt was made by additional legislation on the part of the city government to increase its usefulness by appropriating fifty dollars towards a fund for premiums. The citizens raised by subscription an equal sum, so that at the fair,

which began on the 26th of April, 1805, "premiums to the amount of one hundred dollars were awarded to the best lamb, sheep, steer, milk cow, yoke of oxen, and horse actually sold." A third fair was held in November, 1805, after which they were discontinued.

THE SOCIETY FOR PROMOTING PUBLIC ECONOMY.

Early in the year 1806, Joel Barlow, esq., then residing at Kalorama, in the vicinity of Washington, published the prospectus of a "national academy," in which he enumerated, among the foreign institutions to be copied in forming an American organization, the agricultural societies of England and the veterinary school of France.

Meanwhile an institution had been organized by "members of Congress, officers of the federal government, and others, devoted to objects connected with public economy." Meetings were held at Mr. Hervey's, on Pennsylvania avenue, every Saturday evening, from five until eight o'clock, and among the subjects considered were:

"4. Our mechanical economy, or the means of abridging labor by useful inventions, implements, and apparatus.

"5. Our agricultural economy, or the means of producing the most abundant and most reciprocal crops, under any given circumstances, without doing things by guess.

"6. The economy of our forests, or the best management of our latent resources there."

This was probably the association alluded to in the proceedings of the Philadelphia Society for the Promotion of Agriculture, on the 8th of April, 1806, when Dr. Mease, in describing a machine for hulling clover, recommended that the account "be published in the newspapers, and communicated to the Agricultural Society at Washington."

THE ARLINGTON SHEEP SHEARING.

The determination throughout the Union to wear goods of domestic manufacture gave an impetus to wool growing, and the importation of choice sheep soon became a mania. A fine flock of French merinoes was selected from the royal sheep-fold at Rambouillet, and brought over by Mr. Livingstone; and Colonel Humphreys sent from Spain a flock of seventy-five ewes and twenty-five rams, of pure Spanish merino blood, of which nine were lost at sea, and the remaining ninety-one were landed at Derby, Connecticut, in 1802. Large importations of Spanish merinoes were soon afterwards made, and several flocks were selected for the District of Columbia by William Jarvis, esq., United States consul at Lisbon, who guaranteed the "Paulers" to be of the "true Leonese Transumante merino blood," and the Aquerres, in point of pure blood and fineness of wool, not excelled by any Cubana in Spain." Some of these sheep were sold at fabulous prices, and for some years wool growing was the favorite feature of American agriculture, while "sheep shearings" were the farmer's festivals.

Prominent among these "sheep shearings" were those established, and continued for a dozen years, by George Washington Parke Custis, at "Arlington," his estate opposite Washington, on the Virginia side of the Potomac. Those associated with him in after life in the "United States Agricultural Society," will not wonder that large collections of prominent men used to accept his hospitable invitation to be present at these gatherings, where he entertained his guests beneath the marquee used throughout the Revolution by his illustrious guardian, George Washington. A programme of one of these rural festivals, as published in the Georgetown paper of the day, merits preservation.

"PREMIUMS AT ARLINGTON ON THE 30TH OF APRIL, 1809.

"*Sheep:*

"For the best tup-lamb, of one year, a silver cup, value sixty dollars.
"For the best pair of ewes, of same age, a silver cup, value forty dollars.

"*Principle established:*

"To the sheep which shall possess the best form, and yield the most and best wool in proportion to its size, the premium will be adjudged.

"To the man (being a native American) who shall clip a fleece in the shortest time and best style, by clipping after the English fashion, five dollars.

"*Manufactures:*

"For the national military dress, or uniform of Morgan's riflemen, with a complete statement of the expense accompanying the same, twenty dollars.

"For the best five yards of cloth, yard wide, and composed of cotton and silk—the silk to be derived from articles which have been worn out, as gloves, umbrellas, &c.—fifteen dollars.

"For the best blanket of common size, ten dollars.

"For the best five yards of flannel, to be all wool, ten dollars.

"For the best ball of wool-yarn, weighing one pound, which shall be spun to the greatest fineness on a wheel, to be ascertained by weighing any ten yards in the ball, five dollars.

"To that family, in the county of Alexandria, who shall make it appear that they have made the greatest quantity of wearing apparel of domestic manufactures, and used the least of foreign importations, the largest prize fleece.

"To that family, in said county, who shall prove that to a given number of female children, the most are good spinners, the next largest fleece.

"To the cultivator of the soil, in said county, who shall prove that he has manured most land from his own resources, in the last twelve months, toll free at the Washington Mills for one year.

"WASHINGTON, *November* 20, 1808."

After the premiums had been awarded at these festivals, Mr. Custis would invite his guests to partake of liberal cheer beneath the Washington marquee, and would then "call out" gentlemen from various sections of the Union, giving, as his own contribution to the "feast of reason," interesting reminiscences of his childhood at Mount Vernon. He would always bring forward his project (which may be found in the National Intelligencer of November 24, 1810) of establishing a national agricultural organization, to be incorporated by the government, and attached to a national university. It was published in pamphlet form.

THE COLUMBIA AGRICULTURAL SOCIETY.

In 1809 a number of gentlemen interested in agriculture, residing in Maryland, Virginia, and the District of Columbia, after several meetings, carefully organized the Columbian Agricultural Society. As the germ of a national organization, embracing different States, and as the initiative of agricultural exhibitions, now one of our national institutions, this society's operations are entitled to an honorable record. The National Intelligencer, in publishing its first premium list, said: "Attaching the highest importance to the active development of our internal resources, and convinced that they are the mainspring of the permanent prosperity of the United States, it is with unfeigned pleasure that we insert a statement of the plan and measures of an association whose respectability, zeal, and intelligence are the best pledges for its utility."

The first exhibition of the Columbian Agricultural Society was held at the

Union Hotel, Georgetown, on the 10th of May. It was (said the National Intelligencer of the following Friday) "attended by a numerous assemblage of members of the society, among whom we noticed the President and his lady, the Secretary of State, the Secretary of the Treasury, the Secretary of War, the Comptroller, Register, &c., and many other ladies and gentlemen of respectability. This is the first exhibition held by the society, which bids fair to exceed anything of the kind in the United States, and promises to be of great utility in the promotion of the agricultural arts, and particularly of the domestic manufactures of cotton, wool, and flax, by exciting a competition which cannot but be productive of good effects.

"There were exhibited a great number of sheep of the best breeds, among which were several half and three-quarter breed merinoes. At half past eleven o'clock the room for the exhibition of domestic fabrics was thrown open, when many specimens were displayed highly honorable to the industry and ingenuity of those who produced them, and gratifying to those who have at heart the cultivation of the resources of the country. Some specimens of diaper, bed-ticking, and cotton-bagging were particularly admired as equal to any imported. The result of the day was highly pleasing to all concerned; and the auspicious commencement of this patriotic institution furnishes another, in addition to the many evidences already existing, of the public spirit of the District."

A venerable gentleman who was present described the scene to the writer of this paper as one of great interest, the more especially as nearly every person present wore clothing of domestic manufacture. President Madison sported his inauguration suit, the coat made from the merino wool of Colonel Humphreys' flock, and the waistcoat and small-clothes made from the wool of the Livingston flock at Clermont. General John Mason, then United States Indian agent, wore a suit of nankeen, made from nankeen cotton raised on Analostan island. The sheep were arranged in pens in the large yards of the hotel, (under the direction of Mr. Crawford,) and there were also several fine horses on exhibition, among them Dr. Thornton's "Carlo." This was a large, brown bay horse, (imported by Robert Waln, who had been a member of Congress from Philadelphia,) with a pedigree reaching back thirteen generations to the Layton Arabian mare, and enriched by crosses with the best stock in England. My informant recollected distinctly the admiration expressed by Mr. Madison after examining the horses and sheep.

The secretary's official report states that the committee on sheep were: Henry Maynadier and Brice J. Worthington, of Anne Arundel county, Maryland; William Hall, of Prince George's county, Maryland; George Graham, of Fairfax county, Virginia; and John Cooke, of Stafford county, Virginia. The first premium of one hundred dollars was awarded to Solomon Cassidy, of Alexandria county, District of Columbia, for his lamb, weighing, unshorn and unwashed, 53 pounds 5 ounces, the fleece weighing 4 pounds 13 ounces. The second premium of eighty dollars was awarded to John C. Scott, of Strawberry Vale, Fairfax county, Virginia, for his lamb, weighing, unshorn and washed, 83 pounds, the fleece weighing 3 pounds 14 ounces. The third premium of sixty dollars was awarded to William Marbury, of Blue Plains, Washington county, District of Columbia, for his lamb, unshorn and unwashed, weighing 135 pounds 8 ounces, the fleece weighing 6 pounds 12 ounces. These and the other sheep exhibited were shorn before the committee; and a premium was awarded to Mr. Edward Eno for shearing a sheep in the neatest, safest, and most expeditious manner. Two merino rams were exhibited, sired by "Don Pedro," owned by Mr. Dupont, of Wilmington.

The committee on domestic manufactures were: William Marbury and John Cox, of Washington, District of Columbia; William A. Dangerfield, of Alexandria county, District of Columbia; Gerard Brooke, of Montgomery county, Maryland; and Joseph Cross, of Prince George's county, Maryland. The

premiums were awarded about equally to competitors from Maryland and Virginia.

The proceedings of the next semi-annual meeting of the standing committee (which were published in the National Intelligencer) show that the idea of having sales of articles exhibited at a cattle show was then first announced, viz:

"And to afford still further encouragement to farmers and manufacturers, it was resolved that all those who may have for sale cattle, sheep, or any articles of domestic manufacture, be invited to bring them to the exhibition; that convenient opportunity be afforded to exhibit them to public notice; that stands, proper enclosures, and other accommodations be provided for them, and those who choose it have the benefit of a public auction on the evening of the exhibition, and on the succeeding day at an early hour, it being understood that the auctioneer be paid by the seller a moderate percentage on the amount of all articles actually sold, and that the owners be at the expense of provender and attendance of their cattle and sheep."

The second exhibition was held in what was then known as Parrott's Grove, near the present Boyce estate, on the heights of Georgetown. The National Intelligencer of November 22 says of it: "The second semi-annual exhibition of the Columbian Agricultural Society was held at Georgetown yesterday. A large concourse of members and visitors, with their ladies and families, were present. Among the visitors were the President and family, the Postmaster General, the Treasurer, the Auditor, the Russian minister, mayor, Mr. Barlow, Mr. Irving, and many other ladies and gentlemen of respectability. Owing to the late inclemency of the season, but few cattle were exhibited; but to compensate for this deficiency, there was a great quantity of cotton and woollen domestic fabrics, comprehending much good cloth, blanketing, carpeting, hosiery, &c. The blanketing appeared to be most admired, though much praise was given to several pieces of cloth and carpeting." The following full list of premiums was published in the Agricultural Museum:

"*Premium* 1.—Sixty dollars for the best bull, to George Calvert, esq., Prince George's county, Maryland.

"*Premium* 2.—Sixty dollars for the best cow, with her first calf, to Osborne Spriggs, esq., Prince George's county, Maryland.

"*Premium* 3.—Ffty dollars for the best fat bullock, or spayed heifer for beef, to William Steinberger, esq., of Shenandoah county, Virginia. He was killed the next day at the slaughter-house of Mr. Krouse. He was six years old, and weighed as follows: Beef, 1,402 pounds; hide, 123 pounds; tallow, 190 pounds—making 1,715 pounds; head, 50 pounds; feet, 25 pounds; liver, 48 pounds—making 129 pounds; blood, 87 pounds, entrails, 273 pounds; wastage, 50 pounds—making 410 pounds. Weight of carcass as on foot, 2,254 pounds.

"*Premium* 4.—Forty dollars for the best piece of fulled and dressed woollen cloth, to Mrs. Ann M. Mason, of Analostan island, Washington county, District of Columbia.

"*Premium* 5.—Thirty dollars for the best piece of woollen kerseymere, to Mr. George M. Conradt, of Fredericktown, Maryland.

"*Premium* 6.—Thirty dollars for the best piece of cloth cotton warp, filled with wool, to show the wool on one side, to George M. Conradt, Fredericktown, Maryland.

"*Premium* 7.—Thirty dollars for the best piece of fancy patterns for vests of wool and cotton, to Mrs. Martha P. Graham, of Dumfries, Prince William county, Virginia.

"*Premium* 8.—Thirty dollars for the best piece of flannel, all wool, to Mrs. Sarah McCarty Mason, of Hollin Hall, Fairfax county, Virginia.

"*Premium* 9.—Twenty dollars for the best piece of flannel, part cotton, part wool, to Mr. George M. Conradt, of Fredericktown, Maryland.

"*Premium* 10.—Ten dollars for the best pair of fine woollen knit stockings, to Miss Patsey Shackleford, of Culpeper Court House, Virginia.

"*Premium* 11.—Ten dollars for the best pair of woollen woven stockings. None were offered.

"*Premium* 12.—Thirty dollars for the best pair of fine woollen blankets, to Mrs. Martha P. Graham, of Dumfries, Prince William county, Virginia.

"*Premium* 13.—Thirty dollars for the best pair of fine cotton blankets, to Mrs. Martha P. Graham, of Dumfries, Prince William county, Virginia.

"*Premium* 14.—Fifteen dollars for the best pair of stout coarse blankets for laborers, to Mr. George M. Conradt, of Fredericktown, Maryland.

"*Premium* 15.—Fifteen dollars for the best parcel of flax or hempen sewing-thread, to Mrs. Elizabeth Gunnell, of Minorca, Fairfax county, Virginia.

"*Premium* 16.—Forty dollars for the best woollen carpeting, in the piece, to Mrs. Elizabeth Maynadier, of Belvoir, Anne Arundel county, Maryland.

"*Premium* 17.—Fifteen dollars for the best hearth rug, to Mrs. Elizabeth Maynadier, of Belvoir, Anne Arundel county, Maryland.

"*Premium* 18.—Twenty dollars for the best specimen of durable dye, with the receipt, to Mrs. Martha P. Graham, of Dumfries, Prince William county, Virginia."

The third semi-annual exhibition was held on May 16, 1811, in Parrott's Grove, which was then the property of Thomas Beall, esq., in whose absence Mrs. Beall had placed it at the disposal of the society. The National Intelligencer of the next day says that "it was attended, as usual, by several hundred of the most respectable ladies and gentlemen in the District and neighboring counties of Virginia and Maryland, among whom were the President, heads of departments, and generally all the prominent officers of the government, the French minister, and our minister to France. The show of sheep—merino, mixed blood, and natives—was said to be as numerous and respectable as any ever seen in the country. The manufactures, exclusively domestic, attracted much admiration. The premiums were distributed as awarded by the judges. The pleasantness of the day, the nature of the ground, shaded with forest trees; the fragrance of the flowers, with the various entrances to the enclosure decorated, the presence of the music, and the good humor and gaiety which it contributed to diffuse, rendered the meeting unusually agreeable."

The fourth semi-annual exhibition was held in Georgetown on the 20th of November, and was fully reported in the National Intelligencer of the 21st and 26th. "The day was rainy, and therefore unfavorable to the exhibition, especially of cattle. Of above one hundred that had been brought into the town and neighborhood, not more than six or eight were exhibited, the state of the weather rendered it so inconvenient. The cattle exhibited attracted general notice, especially an extraordinary steer, raised by Mr. Steinberger, of Shenandoah county, Virginia. This animal is believed to be the largest ever raised in Virginia; it is supposed he will weigh 2,700 pounds on the hoof, and near 2,000 pounds net beef. The show of domestic manufactures could not but be pleasing to every person present. The specimens of woollen cloth, blankets, flannels, kerseymeres, carpets, fancy patterns, cotton cloths, &c., evinced the progress which our citizens are making in this branch of economy. Many of the articles were judged to be equal, some were thought superior, to imported fabrics of the same kind."

The fifth semi-annual exhibition of the Columbian Society was held in Mr. Beall's grove, on the 20th of May, 1812, and was well attended, although the embargo and other warlike measures occupied public attention. The report in the National Intelligencer of May 26 says that "the exhibition of domestic manufactures was highly gratifying in point of number of articles, variety, beauty, and quality. There was a greater number of sheep shown than at any

former meeting of the society, especially of the fine-wooled breeds. The judges of sheep were the Hon. Joseph Kent, of the House of Representatives, and the Hon. Thomas Worthington, of the Senate of the United States, and Clement Brooke and John Threlkell." Among the premiums awarded were:

14. Twenty dollars for the best three-horsed plough to break up heavy land, to Wm. Thornton, of Montgomery county, Maryland.

15. Ten dollars for the best two-horsed plough to break up light land, to James Brown, of Montgomery county, Maryland.

16. Ten dollars for the best weeding plough, to go with one horse, to Solomon Cassidy, of Alexandria, District of Columbia.

These ploughs were tested by "Isaac Pierce, Emmor Bailey, John Weeld, David Frame, and John Canly, esqrs., judges of the plough." The premium list adopted December 11, and published December 19, 1811, had stated that the ploughs would be expected to "unite in their construction, durability and simplicity, with steady and easy draught." This was doubtless the *"first field-trial of implements"* in America.

Of the sixth semi-annual exhibition, held at Georgetown, on the 18th of November, 1812, there is no mention in the newspapers, except the premium list, which was published in the National Intelligencer on the Thursday previous. The amount of the premiums offered was upwards of four hundred dollars—among them one of "twenty dollars for the best written essay on the mode of gearing and working oxen, founded on experiments." Unfortunately, however, the war with England overshadowed everything else, and as the time had expired for which the society had been organized, it was dissolved. But its successful exertions in awakening a more general interest in the various departments of husbandry—not only in the immediate vicinity of its exhibition, but in the adjacent States—merit a grateful remembrance by the agriculturists of America. Had the war drum not summoned many of the principal members from their peaceful enclosures to the tented field, there is good reason to believe that its circle of usefulness might have continued to increase. It had already reached the outer counties of Maryland and Virginia, and it doubtless would have gone on enlarging its area of usefulness, until the cultivators of the entire Union had become interested in the Columbian Agricultural Society.

CULTIVATION OF THE VINE AND THE OLIVE.

After what is known as the "last war with Great Britain," there was, for several years, but little agricultural progress, although the number of State and county agricultural societies was every year increased. In 1817, Congress granted four townships of unoccupied land (92,160 acres) lying in that part of the Mississippi territory now comprised within the counties of Greene and Marengo, in the State of Alabama, to Charles Villar, agent of an association of emigrants from France, for the purpose and on the condition of settlement of at least one adult to each half section contained in the said four townships, and for the cultivation of the vine, the olive, and other vegetable productions, no settler being entitled to more than 640 acres; the grantee to pay the government of the United States the sum of $184,320 ($2 per acre) on or before the expiration of fourteen years. It was further stipulated that, within three years from the date of the contract, there should be made upon each tract allotted to the respective associates a settlement by themselves, individually, or by others on their account; that, on or before the expiration of seven years, there should be cultivated at least one acre of each quarter section, taken aggregately, in vines; and that there should be planted within that period, in said four townships, not less than five hundred olive trees, unless it should have been previously established that the olive could not be cultivated thereon.

The report of the Secretary of the Treasury in December, 1867, shows that

there were 7,414 acres cultivated within the above-named tract, principally in vines, cotton, corn, small grain, &c. The quantity of land devoted to the vines was 27½ acres, which, according to an estimate, was not more than one-tenth part of what was originally planted. The vineyards occupied fields which had previously been cultivated with cotton, the vines standing ten feet apart in one direction and twenty feet apart in the other, each fastened to a stake. The number of olive trees standing on the grant was three hundred and eighty-eight, some of which were six years planted and others only three. There were also planted on the tract twenty-five thousand olive seeds. It has been stated that about five hundred French emigrants settled under this concession; yet, comparatively few made any considerable improvements, although extensive and profitable farms were in possession of Americans, who had purchased them from the grantees. The chief reasons assigned for the failure of the performance on the part of the emigrants were not only the natural obstacles incident to the settlement of a new country, but many of them came prematurely into their lands, without funds sufficient to improve their allotments, or even to provide for their immediate support. For several years the colony was remarkably unhealthy, scarcely a family escaping sickness, and numbers of the grantees died. Again, possessing, as they did, but little knowledge of agricultural economy, strangers to the language, the manners, and habits of our people, it is not surprising that they should be retarded in their progress, and be less prosperous than the citizens of the United States.

The chief causes which led to failures in the culture of the olive and the vine were ascribed to the necessity each grantee was under of first obtaining the means of subsistence; the difficulty and length of time required in clearing and preparing the land—nearly seven years elapsing before this was accomplished; yet very early importations of cuttings were made, a large quantity of which arrived out of season, and when we consider the lateness of the period in Europe at which they had to be taken, and the early time at which they must be planted in Alabama, it is obvious that any considerable delay in the arrival of vessels must have caused them to perish on the way. All of the cuttings which arrived alive were carefully planted, though large numbers of them died, owing, as was believed, to the newness of the soil. Again, the kinds of vine imported did not appear in all cases adapted to our climate, and doubtless the modes of culture of Europe and this country were radically different. Finally, the olive trees that were planted perished with every winter's frost, but put up fresh roots in the spring, which also perished with that of the succeeding season.

AGRICULTURAL PROGRESS.

During the administration of John Quincy Adams, instructions were sent to the consuls of the United States to forward rare plants and seeds to the Department of State for distribution. A government botanic garden at Washington was also established, the nucleus of the present botanic and propagating gardens, which have been of such practical utility in the propagation and distribution of rare plants, vines, and trees. Agricultural periodicals and newspapers were gradually established, the State and county agricultural exhibitions were annually held, and there were decided improvements made in agricultural implements and tools.

But agriculture was regarded as a subordinate, if not a degrading, employment. Farmers' boys were made to toil with worn-out tools until they generally escaped to sea or to the city, while the professions were looked upon as the only stepping-stones to honor and a high social position. It is a curious fact, however, that the most eminent of those who deserted the old homestead to enter upon "the golden chase of life," ever yearned for the bosom of mother earth and finally returned to it. Jackson at the Hermitage, Calhoun at Fort Hill, Clay at Ashland, and Webster at Marshfield, each paid a practical homage to agriculture,

and consecrated those spots as heart-shrines to be remembered with Mount Vernon and La Grange. Majestic as was the form of the "expounder of the Constitution" when he stood up in defence of the Union upon the floor of the United States Senate chamber, how much more interesting would be his portrait when, raised on his death-bed, he took a last fond look at his herd of cattle, which he had requested might be driven slowly before his window, one by one.

In 1826, Congress ordered the publication of a well-digested manual, prepared by Richard Rush, Secretary of the Treasury, containing the best practical information that could be collected on the growth and manufacture of silk. In 1828, an edition of a "Treatise on the Rearing of Silk-worms," by Count Von Haggi, of Munich, was printed as a congressional document, and several valuable reports on silk-culture were made and published, until the bursting of the "Morus Multicaulis bubble" checked this branch of agricultural industry.

OPERATIONS OF THE PATENT OFFICE.

In 1837–'38, the necessity for importations of breadstuffs to the amount of several millions of dollars awakened the politicians and the people to the necessity of agricultural improvements. It was evident, when public attention had been called to the subject, that the Anglo-Saxon system of rapacity in the management of farms was continually tending to exhaustion of the soil. The falling off in the average yield per acre, which commenced upon the borders of the Atlantic, spreading from New England down to Florida, was creeping insidiously toward the west. It had been unmistakably shown in New England and in New York, and if we had madly pursued the depletive tillage of those days, the fertile prairies of the west would, ere this, have ranked with the poor soils of the earlier settled east, from which the people have been rushing towards the setting sun like armies of locusts, destroying as they passed along. Agriculturists were straining every nerve in the production of labor-saving tools. Something had to be done, and done quickly, to improve the agriculture of the republic, and it was then that the late Judge Buel, of New York, advocated the establishment of agricultural colleges.

Congress came to the rescue, and, at the suggestion of Hon. Henry L. Ellsworth, Commissioner of Patents, appropriated, in 1839, $1,000 for the "collection of agricultural statistics, investigations for promoting agriculture and rural economy, and the procurement of cuttings and seeds for gratuitous distribution among the farmers." This paltry appropriation was not made in 1840 or in 1841, but was renewed in 1842. In 1843 it was increased to $2,000, which sum was again voted in 1844, and in 1845 the appropriation was $3,000. In 1846 there was no appropriation made, but in 1847 Congress voted $3,000. Since then the agricultural appropriation has been made regularly, and gradually increased until it is more worthy of the nation. The first agricultural report, made by the Patent Office in 1839, contained fifty-four pages, and it was gradually increased in size. Large as were the editions of the agricultural reports, it is already very difficult to procure those of some years.

The Patent Office, through its agricultural division, did much for the advancement of agriculture, and demonstrated the necessity for a Department of Agriculture. Large quantities of valuable seeds and plants were scattered broadcast among the people, with directions as to the best modes of cultivation, while a great mass of facts and theories was accumulated at a common centre, for comparison and subsequent publication. It must be admitted that experiments have been made and seeds distributed which have proved of little profit, yet, in a country possessed of so great a variety of soil and climate, it was wise to essay the propagation of every plant affording any hope of usefulness, especially as each success would more than compensate for all the cost and trouble attending many instances of failure.

THE UNITED STATES AGRICULTURAL SOCIETY.

In 1841 a convention of gentlemen, anxious "to elevate the character and standing of the cultivation of the American soil," was held at Washington to organize a national agricultural society, with the fund which had been bequeathed by Hugh Smithson for its support. The establishment of the Smithsonian Institution prevented the realization of the hopes of those who had desired to make this endowment practically useful, and the national society remained dormant until 1852, when another convention was called to meet at Washington by twelve State agricultural associations. At this convention, held on the 14th of June, 1852, there were present one hundred and fifty-two delegates, representing twenty-three States and Territories, and the United States Agricultural Society was organized. The objects of the society, as declared by the preamble to its constitution, are to "improve the agriculture of the country, by attracting attention, eliciting the views, and confirming the efforts of that great class composing the agricultural community, and to secure the advantages of a better organization and more extended usefulness among all State, county, and other agricultural societies." The society was incorporated by an act of Congress, approved April 19, 1860.

The annual meetings of the United States Agricultural Society, held at Washington city, were, until the commencement of the war, a realization of the National Board of Agriculture, recommended by the farmer of Mount Vernon. Gentlemen from almost every State in the Union (many of them delegates from agricultural associations) were annually assembled to discuss such topics as presented, calculated to advance the cause of agricultural improvement; interesting and valuable lectures were delivered by practical and scientific farmers; reports were submitted by committees specially appointed to examine new inventions and theories, and by delegates who had been accredited to the agriculturists of other lands; and there was "a general interchange of opinion." The great practical truth and characteristic of the present generation," said the farmer of Marshfield, "is that public improvements are brought about by voluntary association and combination. The principle of association—the practice of bringing men together for the same general object, pursuing the same general end, and uniting their intellectual and physical efforts to that purpose—is a great improvement in our age. And the reason is obvious. Here men meet together that they may converse with one another—that they may compare with each other their experience, and thus keep up a constant communication. In this practical point of view, these agricultural associations are of great importance. Conversation, intercourse with other minds, is the general source of knowledge. Books do something. But it is conversation—it is the meeting of men face to face, and talking over what they have in common interest—it is this intercourse that makes men sharp, intelligent, ready to communicate to others, and ready to receive instruction from them."

National exhibitions and field trials were held by the United States Agricultural Society at Springfield, Massachusetts; Springfield, Ohio; Boston, Massachusetts; Philadelphia, Pennsylvania; Syracuse, New York; Louisville, Kentucky; Richmond, Virginia; Chicago, Illinois; and Cincinnati, Ohio. These national exhibitions were self-sustaining, the receipts meeting the disbursements of upwards of one hundred thousand dollars for premiums and expenses; and they not only increased the efficiency of State, county, and local associations, but called together larger assemblages of the people than convened upon other occasions, embracing not only our most intelligent yeomanry, but gentlemen of every art and profession, from every portion of the wide-spread Union, evincing that the national pulse beat in unison with agriculture, and that the public voice was responsive to the call. At the banquets with which these national jubilees were concluded eminent gentlemen met upon the broad plat-

form of good citizenship, merging all sectional jealousies and party distinctions in a general desire to improve and elevate that great calling which gives independence and strength to our nation.

The society published for several years its annual transactions, and also a periodical containing reports of the annual meetings, exhibitions, and operations of the society, with a general statement of the position of agricultural affairs at the metropolis, and reports of the operations of State boards and societies, agricultural colleges, and of all legislative recognition of the predominant interests of the country.

The establishment of a Department of Agriculture was urged at every annual meeting of the society until the desirable result was attained. It was then relieved of many of its self-imposed duties, including the publication of a periodical devoted to the interests of agriculture. The other operations of the society have been interrupted by the rebellion, which rendered it impossible for its officers and members to meet as before; but now that our land is again blessed with peace, it is hoped that the fraternal relations of other years may be resumed, and that the United States Agricultural Society may become an efficient ally of the Department of Agriculture.

AGRICULTURAL PERIODICAL LITERATURE.

It is within the memory of most of the present generation of farmers when J. S. Skinner established the "American Farmer" at Baltimore, the pioneer of an array of agricultural journals, to which may be attributed much of the progressive spirit which now animates our farmers and planters. In the columns of these journals those who cultivate the soil are promptly furnished with the various discoveries which science is constantly making, and are kept posted as to what is being practically done in the pursuit to which they are devoting their energies and their industry.

AMERICAN POMOLOGICAL SOCIETY.

In 1848 a convention of fruit-growers organized the National Pomological Society, which has since held biennial sessions, at which there has been a large attendance of delegates, and the published transactions are recognized as authority on pomological matters. The organization of this society and its example has been followed by the establishment of the British Pomological Society, in London; the *Société Pomologique de Belge*, in Brussels; and other similar organizations located at almost every point of the Union—all working in harmony for the attainment of the most reliable and important results. These are aggregating the experience of the wisest and best cultivators, creating a taste for this useful and divinely appointed art, proving what varieties are suited to each particular locality, and what to general cultivation. These, through the influence of the horticultural and agricultural press, are improving fruit-culture from the Canadas to Mexico, and from the Atlantic to the Pacific, bringing its numberless enjoyments within the means of the most humble cottager, and multiplying the luxuries which crown the tables of the opulent. The large, luxuriant, and abundant fruits in the State of California, in the Territories of Oregon and Washington, already rival, and in many instances surpass, those of our older States; indeed, those of the countries of Europe.

AGRICULTURAL COLLEGES.

The able and exhaustive paper by Hon. Henry F. French, of Massachusetts in the fourth Annual Report of the Commissioner of Agriculture, leaves nothing to be said on these institutions, which are destined, if rightly managed, to contribute largely to the establishment of agricultural science on the sure founda-

tion of well-ascertained facts. It has been well said that if we would improve our present defective system of agriculture—if we would secure its permanent success, and make our land the glory of all lands—we must have institutions well endowed, adapted to such as would be eminent agriculturists. And it is high time, if the *sword* have her colleges supported by law, the *plough* should have hers, believing that it is as much a matter of national policy to *know how to feed men scientifically as it is to kill them.*

THE DEPARTMENT OF AGRICULTURE.

The future historian will commence a new chapter in American agriculture, eclipsing in interest those which have preceded it, with the establishment of a Department of Agriculture by an act of Congress, approved May 15, 1862. The heart-wish of Washington, since echoed by almost every prominent cultivator of the soil, has thus, at last, been realized in the national government recognizing agriculture as entitled to its fostering care, and by its aid in applying the light of science to the guidance of rural labor. Agriculture, after having been kept waiting long, was elevated to its proper position in the political framework of our system of government during a period of civil strife. With a return of peace, the whole Union enjoys the benefits of a Department of government devoted to the advancement of what is confessed to be the basis of all trades, all commerce, and all manufactures. Through its agency those who till the soil will become wiser and better. A flood of light will be shed upon the workings of nature, in the economy of animal life, and in the vegetable productions of the earth, to our national profit and renown. Our free republic will bloom as the rose, and agriculture will be recognized as the most prosperous and the most respected, the most ancient and honorable, the most useful and independent of industrial occupations—

> "Till plenty, rising from the encouraged plough,
> Shall fill, enrich, adorn our happy land."

HIGH FARMING, AS ILLUSTRATED IN THE HISTORY OF THE NETHERLANDS.

BY L. L. TILDEN.

An opinion prevails among the most intelligent and successful farmers in our country that farms are too large to admit of the most profitable cultivation. With few exceptions the owners have not the necessary capital to effect such improvements as are required for the highest development of the capabilities of the soil, and they seek remuneration for their labor in the extent of their farms, rather than improved tillage. The facility with which lands have been acquired has perpetuated the mistake. In the most favored portions of our country—those longest under cultivation—poor men have been enabled by industry and frugality to purchase small farms, and prosperous farmers have easily enlarged their already large estates. As a consequence "high farming"—farming at a considerable outlay of expense with a view to the highest production—has been neglected.

This subject has at the present time a special claim upon our attention. Lands in the older States now sell at a high price. The western States, in which cheap farms have hitherto been procured, are rapidly filling up. It is not easy to procure lands at the government price, unless in States and Territories so remote as to render the expense of removal and the entire change in the social condition of the people a serious objection. The older States have no longer inducements to offer to a rural population, except on the condition of a higher cultivation of the soil. They cannot supply the means of subsistence to their present inhabitants, and large numbers are forced to seek their living by the numerous branches of manufacture which the demands of society and civilization have created. In Massachusetts the number of inhabitants to the square mile in 1860 was 157.83; in Connecticut, 98.42; in Rhode Island, 133.63. This is equal to the number in the old countries of Europe. In the Netherlands, the number to the square mile in 1864 was 147.49; in Prussia, 131. In all the New England States it is estimated that the population has already reached, or, perhaps, has already passed the point of finding a support from the products of the soil, estimating them from the yield of past years.

What, then, shall be done? It is obvious that in most of the towns in the older States there is waste land that may be reclaimed and rendered productive. There are moss and peat and swamp lands, having the very richest soil, that may be drained and brought under cultivation. There are lands liable to an overflow, that renders them almost useless for farming, which may be reclaimed by constructing embankments. There are hill-sides so wet at all seasons that they cannot be ploughed, which can be made available for tillage by draining. In Great Britain it is estimated that one-half the land will be benefited by drainage. This necessity is not created by the peculiarities of her climate. The rain-fall is far less than in this country. Not only is the quantity of rain greater here, but it is far less regular in its fall. "Observations at London for forty years by Dalton gave an average fall of 20.69 inches. Observations at New Bedford, Mass., for forty-three years by Mr. Rodman, gave an average fall of 41.03 inches, or double the quantity in London."* It is obvious, therefore, that our lands would be improved and rendered more productive by drainage, and if only one-tenth of our cultivable lands require it, instead of one-half as in Great Britain, the magnitude of the work is apparent, and the increased production resulting from it must be very great.

The subject of manures also demands increased attention. New lands, covered with a soil formed by the vegetable decay of ages, are productive without the use of manures. In the older States this primitive fertility has passed away. Farmers who live in the vicinity of cities and large villages have facilities for enriching their lands which are denied to those who live in the rural districts. There even the barnyard is insufficient, and resort must be had to manufactured fertilizers—to the production of manures from composts—and diligent industry and a free expenditure of capital are required for this purpose.

Much may be accomplished by the cultivation of small farms, for the energies and means of the farmer being concentrated, he will endeavor by a higher cultivation to secure the largest possible gains. In Belgium very few farms exceed one hundred acres. The number containing fifty acres is not great, while the number containing five, ten, or twenty acres is very large. Every portion of these small farms is made productive in the highest degree of which it is capable. Everything that can be converted into manure is collected and put upon the land. The fields instead of being ploughed are spaded, and are trenched to a great depth; no portion lies fallow, but by a rotation of crops extending through six or seven years, and the constant application of manures, every part is rendered highly productive.

* Farm Drainage, by H. F. French.

Let the farmer imitate examples of successful industry like these. Let him, instead of doubling the extent of his farm, double the increase of his crops. Let him provide more and better shelter for his stock, and thus keep them in better condition and at a less expense. Let him make a greater use of oil-cake, both of cotton seed and linseed, for the purpose of fattening his stock and for increasing the value of manure. Let him study to improve his farm buildings, making his house more convenient for the use of his family, and his grounds around it more tasteful and ornamental.

THE NETHERLANDS AS AN AGRICULTURAL EXAMPLE.

It is with a view to encourage the farmers of the United States to undertake the improvement of their farms and aim at a higher cultivation of them, to regard difficulties however great as not insurmountable, to make a free outlay of capital in view of a sure return in increased production, that the following article has been prepared. Its design is to show by a brief narration how a most remarkable people have triumphed over appalling difficulties and discouragements, and have made a country, which by nature was not fitted for cultivation, and was scarcely inhabitable, the very garden of Europe, and a rich and powerful kingdom.

That country, from its position called low or Netherland, hollow-land, or Holland, in the history of the fifteenth and sixteenth centuries denominated the Low Countries, but now known as the kingdom of the Netherlands, is situated between France and Germany, forming the northwest corner of the vast plain that extends through northern Germany, Prussia, and Russia as far east as the Ural mountains. It is bounded east by Germany, north and west by the German ocean, and south by Belgium. It is about as large as the States of Massachusetts and Connecticut united. By nature it was a vast morass or swamp, with slight elevations formed by the deposits of the Rhine, the Scheldt, and the Mease, and by the sand-banks which were heaved up by the ocean. A belt of wood once extended along the sea-shore, against which the sands were drifted by storms, and which ultimately formed a partial barrier against the waves. Sometimes, however, a violent storm would break through this imperfect protection, inundate the country, and render it almost uninhabitable. Yet it was inhabited at a very early period by a hardy and warlike race that lived chiefly on the products of the sea.

Uninviting as the country was, it continued to be the abode of a hardy people. The greater portion of it was unfitted for tillage, and but small and detached portions of it could be inhabited. Besides its exposure to inundations from the ocean, it was liable to overflow from its three rivers, each of which, after entering the country, is divided into several branches, and which are often swollen by rains and melting snows. The first defences against the sea were made in the second century of the Christian era,* but they were necessarily rude and imperfect. Little more was done than to strengthen the barriers thrown up by the sea against the belt of woods on the shore, while no provisions were made against the overflow of the rivers. From that time, however, to the present, the struggle against inundations has been bravely maintained; and just in proportion to the vigilance and perseverance of the people, has safety for life and property been secured. No other country presents such an appearance to the traveller. It is formed in part by islands, but chiefly by that portion of the continent where the three principal rivers, each divided into several branches, and flowing sluggishly through the marshes into the sea, render it unfit for agriculture. The soil is alluvial, formed by the recession of the sea and by the deposits of sand and mud which are brought down by the rivers. The greater part of it is below the level of the sea. In many places the surface is made lower than its natural condition by the removal of layers of peat, beneath which

* Malte-Brun, Art. Holland.

the soil, when kept free from water, is well adapted to tillage. The description of the country by English poets, though exaggerated, has some foundation of truthfulness. Thus Andrew Marvel speaks of "Holland, that scarce deserves the name land," whose inhabitants—

> "To the stake a struggling country bound,
> Where barking waves still bait the forced ground;
> Yet still his claim the injured ocean laid,
> And oft at leap-frog o'er their steeples played."

And the author of Hudibras describes it as—

> "A country that draws fifty feet of water,
> In which men live as in the hold of nature;
> And when the sea does in upon them break
> And drowns a province, does but spring a leak."

These descriptions are not wholly caricatures. The traveller who now passes over roads which are made on the top of high embankments sees fields and dwellings twelve and even twenty feet below the level of the streams; sees lakes which were formed by irruptions of the sea, driven in by storms, and sees on every side farms divided by canals, and hay and grain borne in boats from the fields to the granaries and barns.

DIKES AND DRAINAGE.

The influx tides and the force of storms, as well as the melting of the snows in regions where the three principal rivers have their rise, would naturally cause the overflow and submerging of the adjacent lands. It was, therefore, indispensable to the safety of the inhabitants, and to the cultivation of the soil, that the sea be prevented, by immovable barriers, from encroaching on the land, and that the rivers, even when swollen by floods, should be confined to their proper channels. These objects were accomplished by embankments, called dikes. Those which protect the country from the sea are of great extent and of marvellous strength. Although the first rude attempts at constructing them were made in the second century, it was not until the fifth that they were made so strong as to afford protection, and even then, and for centuries afterwards, they were broken at times by violent storms, and portions of the country were overflowed. In the year 1230 a furious storm broke the dikes, and so sudden and terrible was the flood which ensued that there was a very great destruction of property and of life. Similar disasters have frequently occurred since that time. The inhabitants have been engaged in one long and desperate struggle to secure safety for themselves; but they entered upon it with an energy and a perseverance which have won the admiration of the world. Taking advantage of the fringes of woods, of which mention has been made, and of sand hills which have been thrown up and compacted by centuries of storm, they constructed embankments of earth, strengthened with bundles of brush cut from trees which had been planted and reared for this purpose, as well as by large blocks of granite, brought from Norway. These embankments are raised to the height of thirty feet, and are so wide as to afford an excellent road upon their summit, while they slope so gradually that a man can easily walk down their sides to the level below. At the base they are 130 feet in width. They are under the constant care of a vigilant corps of engineers and inspectors, by whose watchfulness and skill a feeling of security is inspired in the people as they follow the pursuits of life.

But these defences against the ocean were not all that was needed to prepare the land for tillage, and to render it the abode of an industrious and prosperous people. The rivers, after entering Holland, have numerous branches, the Rhine almost losing itself in the marshy lands through which it flows, and when

swollen by floods, subjecting the whole country to inundation. It was, therefore, indispensable to construct embankments to confine the rivers to a proper channel. The dikes on these streams require a less degree of strength than those on the shores of the ocean, yet they must be sufficient to resist the current when the waters are high. Stone is not found in the country, and could not be used in constructing them. They were therefore built of earth, strengthened by bricks and bundles of brush; and on top of the embankments a roadway was made, paved by bricks set up on the edge. By this laborious process several hundred miles of dikes have been built, the lands have been redeemed from the dominion of floods, and rendered the abode of the most industrious people on the earth.

The next step in improvement, after the construction of the dikes, was to pump the water from the ponds and lakes, and to perfect a system of drainage for the marshes. As the dikes were constructed in successive periods of time, so the great work of draining the swamps and lakes was accomplished slowly. It must be remembered that the land is lower than the sea—is lower than the rivers which flow through it; for the effect of the embankments has been to raise the surface of the streams above the adjacent lands, while the lands have been reduced lower than their natural level by cutting peat for the purpose of fuel. In draining the lakes and marshes it was, therefore, necessary to raise the water by one, and sometimes by two, lifts, and pour it into canals, which were also formed in part by embankments, and from these to discharge it into the rivers, or into the ocean. The land is intersected on every side by ditches. These often form the boundaries of fields and of farms, and on them the products of the farm are conveyed to the barns and granaries of the farmer. The water is raised from these ditches and poured into the canals by means of machinery, which is worked by wind-mills. Before railways were known, these canals were extensively used as roads on which passengers and goods were transported in boats. A windmill costs from $8,000 to $14,000, and so numerous are they that a recent American traveller informs us that he counted two hundred, all in sight at one time. They were used long before steam engines were known, and they were retained in use because Holland has no wood or coal. One such mill will keep 600 acres free from the water which accumulates from the fall of rain, the flow of springs, and the infiltration of water from the embankments. Nearly 500,000 acres are kept dry by the use of 800 of these mills, in North and South Holland alone. Ten other provinces are included in the kingdom of the Netherlands, and the whole number of mills employed in 1840 in draining the lands of the entire kingdom was two thousand.*

Prior to the year 1440 there were in the provinces of North and South Holland one hundred and fifty lakes, varying greatly in extent, eighty-five of which, occupying an area of 223,062 acres, had been drained and reclaimed for the purpose of agriculture. The lake of Harlaem alone contained 45,230 acres. In 1440 the first of these lakes was drained, containing fifty-nine acres. Twenty years later another was drained, containing 694 acres. These experiments demonstrated the practicability of the undertaking, yet a century elapsed before another attempt was made. During this period, however, the country was convulsed by war, and the attention of the government was diverted from internal improvements, and directed to the assertion and maintenance of her independence. No sooner was the oppressive yoke of Philip II of Spain shaken off, and the Dutch republic established, than further efforts were successfully made to drain the lakes and marshes, and thus extend the area of cultivable land in the country. As the lakes served as reservoirs to hold a portion of the rain-water which falls on the surrounding district, the first step in draining them was to cut a canal around the lake which it was proposed to drain, to receive the

* Weal; Dictionary of Terms of Art.

water which naturally flowed into it, while the earth thrown up by digging formed an embankment on the shore. Then by means of windmills, working either scoop wheels or a "screw of Archimedes," the water was raised and poured into the canal, and carried thence to the sea. The land thus drained is a vegetable deposit of surpassing richness and fertility, and, in the language of the country, is called a *polder*.

DRAINING OF HARLAEM LAKE.

No better idea can be given of the herculean task which this people assumed in draining their lakes than by referring to the lake of Harlaem. This lake, like several others, and like the large bay called the Zuyder Zee, was formed by the irruption of the ocean during a heavy storm. It was situated four miles southeast from Amsterdam, and the same distance northwardly from Leyden. Its surface was ten inches below low-water mark on the Zuyder Zee, with which it was connected by the river Y, twenty-seven inches lower than high-water mark, and was fourteen feet in depth. It was formed near the end of the sixteenth century by an inundation, which transformed four small lakes into one sheet of water, and, overflowing the surrounding country, laid several villages waste and destroyed much valuable property. It was thirty-three miles in circumference, and contained an area of a little more than 45,000 acres. Two objects were to be secured by draining it—the protection of the two cities named above from floods when the lake was agitated by severe storms, and the recovery of the land occupied by the bed of the lake for the purposes of agriculture. For more than two centuries the government had felt the desirableness of this great enterprise, but no fixed determination in regard to it was formed until 1836. In the month of November of that year, during a violent storm from the south, the waters of the lake overflowed the banks and threatened the destruction of the city of Amsterdam; while only a month later, during a storm from the north, the city of Leyden was exposed to a similar danger. The government then determined to undertake the work at once, and employed eminent civil engineers to make plans and superintend the work. A canal forty miles in length was first cut around the lake, varying in width from 124 to 147 feet, and nine feet in depth. The soil thrown up in digging was used in making an embankment between the canal and the lake. This embankment was raised to the height of thirteen feet. At some points, where the soil was soft and spongy, or where the canal crossed creeks, it was necessary to use faggots formed into long masses, which were loaded with gravel and sunk and firmly secured by stakes. Three steam engines of 350 horse power each were procured in England, each working eleven pumps of sixty-three inches diameter and ten-feet stroke. These were erected on foundations formed by first digging to the depth of twenty-three feet and then driving piles to the depth of forty feet below that level. The lake was not enclosed and the preparations completed till May, 1848. More than three years were then consumed in pumping out the water, during which period about twenty months were spent in continuous labor. In July, 1852, the work was completed and the sale of the recovered lands commenced. The cost of this great work was $3,592,537; the number of acres recovered was 45,230; and the cost per acre about $79. The entire expense was defrayed by the sale of the lands.*

An American traveller, who visited it three years afterwards, writes as follows: "I found what had so recently been the bed of a great lake to be a region of exceedingly fertile land in a high state of cultivation. It was dry, healthy, and comfortable. Numerous neat cottages were seen in various directions; a population of 2,000 persons dwelt within the *polder*; fields of verdure, enlivened by

*Encyclop. Brit., art. Holland.

cattle, horses, and sheep grazed on the beautiful meadows; and everything the eye could look upon indicated the triumphant achievement of the vast and beneficial design."

It will be seen that the great and formidable difficulties in the way of all agricultural improvements, arising from the natural situation of the country, have been overcome by the indomitable energy, industry, and perseverance of its inhabitants. It is difficult to estimate the expense of the dikes and of the drainage; the cost of the dikes and other works is said to have been $1,500,000,000. A country which, in 1864, contained but 3,700,000 inhabitants, and having an area of only 8,617,000 acres, has been redeemed from the ocean and cultivated like a garden by a people who have just claims upon the respect and admiration of the civilized world.

SOCIAL AND AGRICULTURAL PROGRESS.

It is an interesting and instructive study to trace their progress from the barbarism in which all the Gothic nations were involved at the time of the Christian era, to the condition of freedom and enlightened civilization which they have attained. For centuries a long night brooded over them all, but in none was its darkness greater than in this kingdom. The sword was the only acknowledged force, and the conqueror claimed not only the right to distribute the lands, but also the people with the lands, and thus a system of vassalage prevailed, but one step in advance of chattel slavery. In the lapse of time the Romish priesthood became a power in the land, often working beneficently, treasuring in convents and monasteries whatever of learning had survived the fall of the Roman empire, and teaching all that was taught of divine truth, yet often becoming the ally of despotic power and binding with heavier chains the hands and the souls of men. In the progress of the nation another potent cause of prosperity was trade, and the manufactures which trade stimulates and encourages. The country became a vast work-shop, in which fabrics were wrought that found a ready sale in the marts of Europe and brought returns of wealth to these Netherlands, once so barren and so unsuited to human industries. Cities sprang up and acquired not only wealth, but freedom. Free cities, they were termed, because of certain rights and privileges which had been wrested from the sovereign and are exercised by the people. They had an important influence on the cause of liberty, for they were governed by law, had chartered rights, and the citizens of each had a voice in framing and executing the laws.

Thus slowly, during a progress of thirteen centuries, did the Netherlands become an enlightened and powerful state, enjoying a greater liberty than any other European nation. Nature had apparently condemned her to perpetual poverty; her soil was lower than the waters of the adjacent sea; swamps and lakes abounded on every side; the air was damp and the winters cold; yet here a hardy, brave, noble race of men was preparing to battle for their rights and to assert with their blood the great principles of civil and religious liberty. The struggle was long, for it was maintained against the most powerful nation in the world; but it resulted in securing freedom for herself, and in promoting by her example and influence the cause of human progress. She became a power among the European nations, planted her colonies in the four quarters of the globe, surpassed all others in the extent and richness of her commerce, became an asylum for persecuted Protestants, founded libraries and universities with munificent endowments, and gave to the world an illustrious succession of wise and learned men.

This country has a special interest in the minds of American people. Many of its citizens, at an early day, emigrated to this country, and their descendants were distinguished for high qualities of character, and became useful members of our common fraternity. Not a few of the best families in the State of New

York are proud to trace their descent from Holland. She was the first nation that achieved for herself civil and religious liberty, and thus she became an example and an inspiration. She afforded an asylum for many years to the Puritan settlers of New England, where they formed a higher appreciation of liberty, of education, of freedom of thought and speech, and of those seminal principles which underlie all our institutions. Their residence in Holland assisted in preparing them for the great part they were to act in laying the foundations of empire in a strange land. Not the least valuable of the forms and institutions for which they were indebted to their residence in that land are the division of the country into townships, and committing to towns the internal regulation of their own affairs; the appointment of select men as municipal officers; the registry of deeds, the advantages of which over the English system are incalculable; and the establishment of highways, and the erection of houses and farm buildings along the line of travelled roads.

But another reason is still more important to farmers. The history of Holland shows what can be accomplished in agricultural improvements by industry and perseverance. Many thousands of acres of what was once an impassable morass have been reclaimed, and made the abode of a people who possess wealth, the means of education, and the institutions of religion. A great and free people, distinguished alike for wealth and refinement, for their attainments in high art, for their learned men and universities, and though "last, not least," for an admirable system of free schools, now inhabit peaceful homes, and are foremost in the enjoyments of civilized life, in a territory which has been reclaimed, and is kept free from the peril of storm and flood by the most remarkable industry the world has ever seen.

The number of provinces which now compose the kingdom of the Netherlands, if we include the Duchy de Luxemborg, is twelve. They are as follows:

	Population in 1864.
North Brabant	421, 009
Gueldre	424, 410
South Holland	661, 321
North Holland	561, 259
Zealand	175, 066
Utrecht	170, 291
Frise	286, 066
Overyssel	247, 694
Groninque	221, 724
Drenthe	103, 254
Duchy de Limborg	221, 510
Duchy de Luxemborg	206, 140
	3, 699, 744

Considering the limited extent of its territory, the kingdom contains a large number of populous cities. There are fifteen which contain each a population exceeding 20,000, and thirteen others which contain each over 10,000. Amsterdam has a population of 261,455, and Rotterdam 114,052.*

The climate is such as would naturally belong to a country situated like this. The air is damp, and often heavy with fogs. In winter the waters are frequently frozen, and even the large bay of the Zuyder Zee is sometimes frozen over. The temperature is sometimes as low as 23° below zero. In summer, cold nights often succeed hot days. Changes from heat to cold and from cold to heat are often sudden and severe.

* Almanach de Gotha, 1866.

The whole number of acres of land in the kingdom, according to a return made in 1864, was 8,617,000. Deducting waste and uncultivated land and roads and waters, about 6,000,000 of acres are under cultivation, more than half of which is in grass. In South Holland the proportion of pasture and meadow to arable land was as 2 to 1, and in Friesland as 8 to 1. The grass is of the finest quality, and the lean cattle which are annually imported from Norway and Denmark fatten rapidly when fed upon the polders. To the excellence of the grass is owing the good quality of the milk of the cows, and the superior quality of Dutch butter and cheese. The farms are usually small, and are cultivated with the greatest skill. They are separated by ditches for the purpose of drainage. The land is often thrown up into beds, with a narrow ditch between them. The ditches are often so wide that boats are moved upon them for the purpose of carrying the products of the fields to the barns.* Rich as the soil is by nature, great pains are taken to increase its fertility by manures. Liquid manures, collected in reservoirs, are pumped out and distributed over the fields, after the manner of watering the streets in our cities. The quantity of animal manure is increased by adding to it turf, the sweepings of the streets, and everything that can be used for enriching the soil. Nothing that can possibly be useful to the land is suffered to be wasted. Green crops of clover, buckwheat, or lupin are often ploughed in. Great use is made of the ashes of peat, which is universally used as fuel. The cisterns which are used for collecting liquid manures are placed outside the stables to prevent noxious gases from injuring the health of the cattle, and their contents are often added to the compost heap, where they are thoroughly intermixed and incorporated with it.

DAIRIES.

The Dutch dairies are remarkable for their neatness. The cows are pastured in summer, and are milked in the field. The farm-house is large, one story in height, with a high four-sided roof, forming an apartment for the storage of hay and grain. Adjoining the kitchen are the stalls in which the cows are kept in winter. These are often washed and scoured and sanded, like the apartments used by the family. A large cistern, placed at a little distance, receives all the slops of the kitchen, which are transferred, from time to time, to the compost heap. The farmer, coming from the field, changes his shoes at the door. An English traveller visited a dairy at Broek, and says that the Dutch dairies are all built on one plan. They consist of a house of one story, and of great length. The stalls for the cows run along one side of the building, another side is devoted to the making of butter and cheese, and the remainder of the interior forms the dwelling of the family. The cows and the family enter at the same outer door; but the floor of the stable is made of brick, and is scoured daily, and kept as clean as the kitchen. All travellers describe the Dutch houses as remarkable for neatness. "Go into any kitchen, no matter in what dwelling, and there you will see the pure white marble floor, not a particle of dust or dirt visible, and the kitchen utensils polished to the brightness of mirrors. Next, go into the streets, and see the servant girls scrubbing the brick pavement in front of the house, and slashing the water about the doors and windows, in front of the house, with buckets and a small force pump. See all this, and acknowledge that the Dutch women are animated by a strong and all-pervading love of cleanliness."†

FUEL RESOURCES.

To increase the quantity of cultivable land the government encourages the digging of peat. When this is removed to the depth of several feet, there is

* Henry Coleman—European Agriculture.
† William Chambers's Tour in Holland and Countries on the Rhine.

usually found underneath it a layer of good soil. There is no coal or other mineral wealth in the country. Peat is extensively found, and the preparation of it for fuel is an important branch of industry. Besides the turf-like form in which it usually appears, there is much taken up in a soft, semi-fluid state, not unlike tar, which, when pressed and dried, is the best quality of peat. It burns without smoke, and a piece once ignited retains the condition of a red-hot cinder for hours, until it moulders away into fine ashes. It is burned in foot-stoves, in houses and churches, and is used in dining-rooms to keep hot tea and coffee and other food. When this layer of peat is removed, the cleared space becomes a fertile field, and is kept dry like other fields in that country.

Labor and capital are continually applied to reclaiming bog land, and to constructing embankments on lakes and streams. There is a constant endeavor on the part of the government and the people to reduce the quantity of uncultivated land, and they do not shrink from the labor and expense demanded for this purpose.

STATISTICS OF PRODUCTIONS.

The rearing of stock together with dairy husbandry is a great source of wealth to the farmers. Lean cattle are imported, principally from Denmark, which fatten rapidly on the rich pastures of the country. In 1859 an official report states that the live stock consisted of: Horses, 236,732; horned cattle, 1,232,199, of which there were, cows, 884,946; asses and mules, 3,000; sheep, 795,897; swine, 259,031; goats, 111,404.

From a report made to the Foreign Office in 1862, and published in the Farmers' (British) Magazine, it appears that many of the products of the Netherlands are the same as in England, but that some, as madder, tobacco, hemp, and chiccory, are either unusual or unknown in English husbandry. Rye is the grain most raised, and furnishes the principal food for the lower class of people. The quantity of grain raised is adequate to the consumption of the country. The average production is as follows: Wheat, 21 bushels per acre; oats, 33; barley, 29; rye, 15. Of root crops: Potatoes, 121 bushels per acre; mangel wurtzel, 10 tons per acre.

The average yield of a farm in North Brabant, of one hundred and eighty-two acres, under high cultivation and paying a good interest on the investment, was: Wheat, 31 bushels per acre; rye, 35; barley, 54; oats, 65; beans, 42; peas, 28; mangel wurtzel, 21 tons per acre.

In 1853 the following statement of farm products was made officially: 177,065 acres in wheat produced 2,634,136 bushels; 448,648 acres in rye produced 7,064,288 bushels; 108,316 acres in barley produced 3,486,928 bushels; 211.218 acres in oats produced 7,844,680 bushels; 157,489 acres in buckwheat produced 3,792,440 bushels; 25,233 acres in peas produced 630,240 bushels; 32,404 acres in beans produced 2,724,064 bushels; 216,074 acres in potatoes produced 20,839,652 bushels; flax, tobacco, and other crops not given.

A writer in the Farmers' Magazine, who attended the annual meeting of the agricultural society of Holland in 1863, says that the show of cattle was good, especially of milch cows, which were of native breed, and which "yielded incredible quantities of milk." Fruit, he says, was fine, especially apples and pears. "Fine collections of wheat, barley, and other kinds of grain were exhibited, and the weight of mangolds, turnips, cabbages, and potatoes was astonishing."

EDUCATION AND MORALS.

We should have but an imperfect idea of the place which any nation occupies in the scale of civilization if we looked only at its industry and the development of its material resources. Hence we must observe the progress of education and

the state of morals among a people, and find the degree of mental cultivation which they have received and the extent to which crime is restrained.

In both these respects the Netherlands will compare favorably with any country. An admirable system of common schools exists, in which provision is made for the education of the poor, and in some of the provinces nearly every child of suitable age attends school. The late Prof. Bache, when president of Girard College, made a tour through Europe, examining the schools of every kind in England, Scotland, France, Holland, Germany, Prussia, and Switzerland. In the able and excellent report made to the trustees of the college on his return, he says of the schools in the Netherlands: "Among the primary schools of Holland are some of the best which I visited, and the whole condition of popular instruction is worthy of a nation which has ever been distinguished for its virtue and intelligence." The proportion of children attending school in all the provinces is exceeded by no country, unless we except Prussia. Each community or neighborhood is required by law to maintain at least one school. Competent teachers are provided, and the whole system of instruction is supervised by a board of education. In addition to common schools there were, in 1857, 944 schools or academies of a higher grade, containing 81,000 pupils, and 63 Latin schools, containing 1,802 pupils. Besides these there were three universities which contained 1,327 students. The high character of these universities is well known. The scholars who have been trained in them for eminent usefulness in all the learned professions have ever held a high rank in the republic of letters.

Nor has she been less distinguished for the hold which moral and religious truth has had upon the popular mind. Her struggles in the cause of civil and religious liberty against a gigantic despotism have been described with the pen of a master by one of our most eminent historians. Embracing the truths taught by the reformers, claiming liberty of conscience, rejecting the authority of tradition, and adopting the Bible as their rule of life, her people struggled for eighty years to achieve their independence and were successful. The prize was worth the contest, for civil liberty in Europe, so far as it is enjoyed by any nation, and perfect civil and religious liberty in America, was the result of the contest.

A people thus trained was prepared to appreciate the pure morals which are inculcated in a religious community and which, to a greater or less extent, are a rule of life. The sanctities of the Sabbath and the sanctuary are very generally regarded, and although the population of the cities is proportionally larger than in any other country of Europe, there is much less crime than in any other European cities. The untiring industry of the inhabitants, the excellent instruction of the schools, together with the religious counsels of the clergy, have co-operated in rendering the country more free from crime than Belgium or France, and have caused, particularly during the last half century of peace, a steady advance in the social condition of her people.

COUNTRY ROADS.

BY HENRY F. FRENCH, OF BOSTON, MASS., ASSISTED BY I. HERBERT SHEDD, OF BOSTON.

LOCATION OF ROADS.

It may be said in general terms that the best line of road between two points is that which is shortest, most level, and cheapest to build and maintain, having reference to the kind and amount of travel it is expected to accommodate. It is manifest, however, that we can rarely adopt the route which is absolutely the shortest or most level possible, because of the intervening natural obstacles, such as hills, valleys, and streams, to overcome, which would often involve expense inconsistent with true economy. It is often practicable to cut through a hill or to fill up a valley, so as to construct a road both straight and level, at a cost not exceeding that deemed economical in the construction of a railway, but which would be justly considered extravagant and unjustifiable in building a common highway.

There are other considerations beside that of economy which enter into the practical question of the precise location of a road. Some of these are of such a nature as very seldom receive much attention from "selectmen," or road commissioners, or even engineers, and yet they have an important influence on the development of the country into rural homes for a cultivated people. After our physical wants of food, clothing, and shelter are met, and the comforts of life are provided, we strive for the gratification of taste; and for nothing do we more willingly expend money than to enjoy the natural beauties of the landscape, with its wealth of forests and lake, and plain and river.

The borders of common roads are the convenient and usual sites for dwellings, and hence it is important so to establish these roads that they may at the same time furnish a safe and easy passage to the traveller and render the country through which they pass most attractive and valuable to its inhabitants.

A highway depends usually for its repair upon the labor of those who live along its line, and even if well constructed is seldom well maintained, unless it furnishes comfortable and attractive building sites. Primarily, we attend to the demands of traffic and business, yet in all the older portions of the country there is a large amount of what is termed pleasure travel, which always selects an agreeable route; and even the teamster, who seeks only the best way to his destination, feels safer in drawing his load through a settled country, where in case of accident he may find shelter and assistance. Therefore, highways are to be established where they will best accommodate those who, from all the various motives of business, convenience, or pleasure, may desire to use them.

In locating a highway we practically turn aside from what, on simply engineering grounds, is our best route, for various reasons. We hesitate, for instance, to cut a road through a churchyard, or to destroy a valuable tree or other ancient landmark, and we leave a direct course from motives of economy to find a narrow place of bridging a river, or to avoid the expense of crossing a pond.

A straight line, too, in an uneven agricultural country, although economical and the best, regarding only the travel from end to end, may so injure the farms through which it passes by deep cuts or by embankments, as to render them inaccessible or quite inconvenient of approach, and so detract from their value; when a deviation, very slightly increasing the distance, would leave the estates not only uninjured but increased in value. Highways are for the public good; and the interest of the towns or counties which construct and maintain them, and

he rights of the owners of land taken for them, as well as the accommodation f the travelling public and the traffic of persons residing in the places connected y them, are always to be weighed in deciding the final question whether the ublic good on the whole requires the highway.

It is true that damages are awarded to the owners of the land over which a ublic road is laid, and theoretically, though often not actually, the owners reeive compensation for all the injury they sustain. This view, however, does ot materially change the practical result. The best route, upon strictly engieering principles, may lead directly through a dwelling house so valuable that all vould see that true economy requires a deviation to avoid the destruction of the uilding and the cost of paying for it. So, in a lesser degree, injury to the estates passed over, whether to buildings, gardens, or farms, may be regarded as an element in the decision of the final question as it is presented to the authorities charged with the power of establishing public highways.

Although it may appear from the foregoing suggestions, that the precise location of a road must be always more or less controlled by considerations of convenience, taste, and economy, outside the province of a mere constructing engineer, yet it is none the less important rightly to weigh and appreciate the considerations which relate to the grades and width and shape, and to the materials and cost of construction of the roadway, than it would be if the latter were the only points of inquiry.

To answer rightly the final question whether the public accommodation demands the interference with private property without the owner's consent, and its dedication to the public use for a highway, it must be determined in advance not only how much damage individuals will suffer by such interference, and how much advantage the travelling public will receive by opening the proposed road, but also whether it is economically possible to construct and maintain it sufficiently level, short, safe, and hard and smooth of surface to accommodate the intended travel. As all these are preliminary to the adoption of a definite route, they may be conveniently considered under the head of

SELECTION OF ROUTE.

Since the selection of a particular route must depend upon its satisfying the requirements for a good road, we will consider these requisites under the following titles:

1st. Directness, and loss by curves;
2d. Undulations;
3d. Grades;
4th. Soil and materials.

Directness—loss by curves.—As every variation from a straight line increases the distance of travel, it is important to consider what sacrifice it is proper to make to preserve a direct course, and, as an element in this question, to determine how much such variation as is proposed increases the length of the route. An investigation of this point will show that the popular impression that roads should be straight at almost any sacrifice, is very erroneous. That such has been the popular idea, is evident by the most superficial inspection of the turnpikes, which, some fifty years since, were constructed throughout New England. Many of these roads were made absolutely straight, as to lateral direction, over hills and through swamps, for many miles, in a very uneven country. The saving of distance, when measured on a plane, as compared with the old country roads, was very great; but the result in almost every instance has been a financial failure, because the advantage of directness was greatly outweighed by the loss from steep grades. It was possible, indeed, by a great sacrifice of horsepower, before the introduction of railways, to convey the mails and a limited number of passengers over those hilly routes in shorter time than over the

crooked, ill-constructed country roads; but the expectation that heavy freight would ever be carried over these turnpikes was disappointed. What seems a great deviation from a straight course may add very little to the actual distance to be travelled. Between two points a thousand feet apart in a direct line, a variation of one hundred feet from that line at the centre, on a regular curve, will add but about twenty feet to the length of the route. Upon the question, whether it is desirable to have roads perfectly level, we find some disagreement. Parnell, who is high English authority, says a perfectly flat road is to be avoided, because a slight longitudinal slope is essential to proper surface drainage; and we have no hesitation in adopting this opinion as correct. The point is suggested here because of its bearing upon the subject of directness. In practice we are constantly diverted from a straight line by undulations, more or less marked, and may at pleasure, by more or less cutting and filling, construct our road perfectly level or otherwise. In avoiding a hill by going round it, we may often adopt a level line, or we may assume a shorter one by adopting any grade we think proper, in keeping higher up on the slope. In view of every consideration, except drainage, the level line is probably best; but as drainage is essential, and, as will be seen when we come to consider the construction of roads, it is desirable to make them as flat as possible transversely, a slight slope in the length of them is found expedient. This slope should be about 1 in 200, which is sufficient for surface drainage without injury by washing, and adds little to the draught.

Undulations.—It is a common impression that a road formed with gentle undulations is easier for a horse to pass over than a dead level. It is based upon the idea that an occasional change from ascent to descent, and the reverse, brings into play different muscles of the animal, and so rests them in turn, while a level road brings a constant strain on the same muscles. Professor Mahan says: "A road on a dead level, or one with a continued and uniform ascent between the points of arrival and departure, when they lie upon different levels, is not the most favorable to the draught of the horse. Each of these seems to fatigue him more than a line of alternate ascents and descents of slight gradients; as, for example, gradients of 1 in 100, upon which a horse will draw as heavy a load with the same speed as upon a horizontal road." The same writer says that "experience has further shown that a horse, at the usual walking pace, will attain, with less apparent fatigue, the summit of a gradient of 1 in 20 in nearly the same time that he would require to reach the same point, and trot over a gradient of 1 in 33." Of this idea that alternations of ascents, descents, and levels are easier for the horse than continuous level, Gillespie says: "Plausible as this speculation appears at first glance, it will be found, on examination, to be untrue, both mechanically and physiologically; for, considering it in the former point of view, it is apparent that new ascents are formed, which offer resistances not compensated by the descents; and in the latter, we find that it is contradicted by the structure of the horse." The question was submitted by Mr. Stevenson to Dr. John Barclay, of Edinburgh, "no less eminent for his knowledge than successful as a teacher of the science of comparative anatomy;" and he made the following reply: "My acquaintance with the muscles by no means enables me to explain how a horse should be more fatigued by travelling on a road uniformly level, than by travelling over a like space upon one that crosses heights and hollows; but it is demonstrably a *false idea* that muscles can alternately rest and come into motion in cases of this kind. * * Much is to be ascribed to prejudice, originating with the man continually in quest of variety, rather than with the horse, who, consulting only his own ease, seems quite unconscious of Hogarth's 'line of beauty.'" We apprehend that opinions on this point, based upon careless general observations, would have little value. Whether, as Mahan supposes, a horse can walk to the top of a hill more easily than he can trot to it on a larger and gentler slope, depends very

much upon the qualities of the particular animal in question; for, while a trotting horse might go twice the distance round a hill with a light load with less exertion than to draw it up the hill, a draught horse would draw the load easily up the hill, and be entirely incapable of trotting round it in the same time. Nor should we have much faith in the opinion of a physiologist, however eminent, who should pretend, by anatomical investigation, to determine whether a horse can go over a level road more easily than on alternate gentle grades, since we know that the breed and habits of horses may make the ascent or descent of hills more or less easy to them. We have some faith in the old saying, that "What everybody says must be true," and should place confidence in the notion that undulating roads are easiest, were it universal. We find, however, that it is not, and that the opinion of sporting men contradicts it, because race-courses and trotting tracks are always, if possible, constructed nearly level, from which we may fairly infer that, for swift driving at least, the level track is best. The question is rather theoretical than practical, since, as we have seen, a slight inclination is advisable for drainage purposes, and nobody advocates more than very gentle undulations for the relief of horses; and, again, the country generally does not afford routes of any extent lying upon dead levels, except upon prairies and pine plains, or through swamps; and in such positions, even the advocates of undulating roads would hardly advise the construction of artificial elevations.

Grades.—It is a fact in science that a body once set in motion will continue to move onward in a straight line until it be stopped by the action of some external force. A carriage set in motion should, on this theory, continue to move until checked by some opposing power. The principal forces which thus check, and finally overcome, the momentum or moving power of carriages upon common roads are gravity, friction, and collision. Gravity being the tendency of a body toward the centre of the earth, or, in common language, to fall, is the force to be overcome in raising it above its present level, as in drawing a load up a hill, and may, therefore, be properly considered under the present head. Friction and collision relating rather to the smoothness and hardness of the surface of the road, will be treated of in another place. Upon a road perfectly level and hard, gravity would offer no impediment to the passage of a carriage with wheels perfectly round and solid. It is not, however, possible to construct even a railway so entirely inelastic that the rails do not perceptibly bend under the weight of the engines, and the best paved roads offer so much irregularity of surface, from sinking under the wheel, or from unevenness of the material, or from dust or gravel upon it, that practically much lifting power is constantly exerted to propel the load over them, in addition to that necessary to overcome friction, collision, and the resistance of the air. As hills of high or low grade are the great obstacles to be overcome in road-building, it is important to appreciate fully the principles which govern the passage of carriages and horses over them. Parnell says, in general terms, "If it were not for the hills that are usually met with on turnpike roads, one horse would do as much work as four; for it is well known that the force of draught must be increased in proportion to the steepness of hills."

Although it is true that the actual resistance of gravity is *relatively* less on a rough than on a smooth road of the same inclination, yet there are other considerations which add to the loss of power in ascending hills. The power of the horse, owing to his anatomical structure, is much lessened in ascending steep acclivities, and it is to be considered that, besides this, he has his own weight to raise to the perpendicular height of the hill. It is said, therefore, that although a horse on a level is as strong as five men, yet on a steep hill he is not as strong as three men; for three men, carrying each 100 pounds, will ascend faster than a horse with 300 pounds. In cold climates the ice which often forms on hills affords an additional reason for avoiding steep grades, whether considered as ascending or descending; and at all seasons steep hills are subject to washing by rain or melting snow, rendering them dangerous as well as difficult.

A writer in the Cyclopedia of Agriculture thus discusses "the relative advantages of different gradients;" in other words, the considerations of how much additional length of a level road will be equivalent to an inclined plane of a certain steepness, or conversely, what steepness of gradient may be afforded in consideration of a decrease in the length:

"The measure of the power required to overcome an ascent is the product of the weight by the height to which it is required to be raised. The motive power, therefore, must be sufficient not only to move the weight along the road, but also to lift it vertically to the required height. When this power is steam, and can be obtained of sufficient magnitude to overcome all the accidents of the route, the roads might be so constructed as that the ascents would be brought together into a perpendicular lift; and in this condition the minimum power will be required. From this, too, we conclude that with steam power the shortest route would be best, however great the slope. But the tractive force for which we have to provide is that of animals, which requires for its employment a gradient less steep and a route more extended. * * But there is still another limit of steepness which should not be exceeded. This is *the angle of repose*, or the steepest slope down which a carriage will not roll of its own accord, by its own gravity. This angle will vary in some degree with the nature of the surface of the road, and also with the construction of the carriage."

The angle of repose is variously estimated: by Dr. Lardner, at one in forty; by Mr. Telford, on ordinary roads with ordinary carriages, as not exceeding one in twenty-four. If roads are steeper than this angle of repose, the force of the horses is exerted in holding back the load, and time is lost, because they cannot with safety be driven rapidly down the hill. When the slope is about one in thirty-five, horses may proceed at their ordinary speed down the slope, even in a fast coach. The actual loss of power by steep grades is shown by the following table from the work last cited, which exhibits the rate of inclination, the angle with the horizon, and the equivalents in length, of level roads:

Rate of incline.	Angle with horizon.			Equivalent, (A level road being 1.)
	°	′	″	
1 in 500	0	6	53	1.102
1 in 400	0	8	36	1.128
1 in 300	0	11	28	1.170
1 in 200	0	17	11	1.255
1 in 100	0	34	23	1.510
1 in 90	0	38	12	1.566
1 in 80	0	42	58	1.637
1 in 70	0	49	7	1.728
1 in 60	0	57	18	1.850
1 in 50	1	8	6	2.019
1 in 40	1	25	57	2.274
1 in 30	1	54	37	2.699
1 in 20	2	51	21	3.538
1 in 10	5	42	58	6.067

It is usually easy to obtain gentle slopes by an increase of the length of the road, and it is believed that the importance of avoiding steep grades, even at the cost of increased length, is not properly appreciated.

Another important consideration is connected with this part of the subject. When a road is to connect two points, whether intermediate or terminal in the route, one of which is higher than the other, there should be, if possible, a regular inclination, or at least no ascents towards the lower, or descents towards the higher, point.

Sir Henry Parnell gives a striking illustration of the effect of inattention to this, on the road between Barnet and London. Barnet is only 500 feet higher than London, yet the road was so laid that a horse going from London to Barnet must ascend more than 1,300 feet, and in going *down* from Barnet to London the horse must actually ascend 800 feet. This manifest waste of power finds its parallel on almost every road we travel, successive hills and valleys being constantly traversed, and often when a little engineering skill at the outset might, with less expense, have found and constructed roads comparatively level. It is impossible to fix any precise limits to the inclination allowable on a highway, because so much depends on the natural face of the country, whether level or mountainous. Telford endeavored to limit the ascent on the great roads constructed by him, to three and a half feet in one hundred, and made considerable circuits in order to adhere to this principle. Occasionally, however, he found it necessary, for a short distance, to use a grade of five feet, and, in rare instances, of even six and two-thirds in one hundred. The usual limit prescribed in Massachusetts, when practicable, is five feet in one hundred.

Soil and materials.—Confining the discussion of these points to their bearing on the question of the location of the road, we refer, for a more full and careful consideration of the qualities of materials best adapted to the building of highways, to our subsequent division of construction.

The cost of constructing a road in the first instance must depend much on the condition of the natural surface of the ground over which it passes. In New England, in addition to the cutting and embanking, the general route of a proposed highway is often encumbered with rocks, forest trees, or stumps, and a slight variation from a direct line, or a deviation in one direction instead of another, may enable us to adopt a route comparatively free from such obstructions. As the cost of constructing is the common objection urged by the tax-payer against the establishment of highways, and as this cost depends very much on the character of the natural surface of the ground, this point is worthy of attention. Again, in a broken country a variation of a few rods in one or the other direction often carries the route from a swamp to a hillside; or from a springy hillside requiring expensive drainage to a sound gravel naturally dry enough for a foundation, or perhaps almost fit for the roadway itself; and often banks of gravel are found at points more or less remote, in regions where the general surface is of clay or soft loam. The general question as to whence the necessary materials for foundation and surface, as well as for stonework of bridges, culverts, and like structures, are to come, is, therefore, to be kept constantly in mind in the preliminary matter of location; and this not only as it relates to the cost of first construction, but as it relates to the permanent maintenance of the road, which is frequently the more serious consideration, especially where roads are opened in the unskillful and imperfect manner usually practiced by the town and county officers. It is very easy, by ploughing and scraping, by combining the sods and soil with the clay or sand beneath, to form a pathway that will look very much like a good road, and be, in fact, as good as others in the neighborhood during a single season, when the labor expended has been worse than wasted, inasmuch as the soft substances of the surface must be all removed, either by gradual amendments or a single thorough process, before a good road can be made. The question of location, therefore, involves the cost of first construction and of maintaining, in proper condition, the proposed road; and the items which constitute the cost depend mainly on the natural condition of the surface and of the subsoil, and upon the convenient supply of the materials of construction and repair. The chief element of the cost of materials is usually in the carriage of them, since earth and stone cost little or nothing.

Long level reaches of cutting should be avoided, and the grades through all cuttings should be so arranged that a sufficient fall for temporary and permanent drainage out of the cut may be secured.

CONSTRUCTION OF ROADS.

The foundation.—To construct a road which shall be smooth, hard, and inelastic, the first requisite is a substratum, either natural or artificial, which shall at all seasons be firm and unyielding. Upon solid rock, and upon gravel so situated as to be drained by natural causes, we can make no improvement. Whatever the structure of the roadway, and however deep we excavate, the road finally rests upon the natural subsoil, and this must carry not only the weight of stone or gravel which constitute the roadway, but also that of the animals and carriages which pass over it. Mr. Mac Adam is frequently quoted as having said that he did not care whether the substratum were hard or soft, and that he should prefer a soft to a hard one. That he did so state before a parliamentary committee is true, and he is even reported to have said that "if it was not such a bog as would not allow a man to walk over it, I should prefer it." Precisely what was in his mind in making these statements is not important when we consider his further opinions and directions. He says: "It is the native soil which really supports the weight of the traffic; that while it is preserved in a dry state it will carry any weight without sinking; that this native soil must be previously made quite dry, and a covering impenetrable to rain must then be placed over it to preserve it in that dry state; that the thickness of the road should only be regulated by the quantity of material necessary to form such impervious covering, and never by any reference to its own power of carrying weight."

The roadway should be, as nearly as possible, inelastic, for it is evident that if it be otherwise the wheels of the carriage are constantly pressed into it, and so are continually overcoming the inclination caused by the depression. In other words, the wheels are continually in little hollows and ascending little elevations, or what is the same, bearing down these elevations to a level, thus increasing the necessary motive power. A railway, which is only a road more nearly approaching the true idea of a level, hard, and inelastic way, furnishes a familiar illustration of what is desirable in a highway.

Drainage.—To render the foundation of common soil capable of bearing up the surface materials and carriages, it is absolutely essential that it be at all times dry, or at least free from stagnant water. That it is possible to construct a road that may be excellent over a quaking bog, twenty feet deep, without drainage, is no doubt true, just as it is possible to lay a bridge of boats across a river; but this is not within the scope of the present division of the subject of road-making.

The point in which, more than in any other, highways are defective in this country, is in being wet at the foundation, and the first thing to be attended to in their construction is thorough drainage.

The evils attendant on a wet foundation are numerous. The roadway has a constant tendency to sink by its own weight and that of the transportation, and so to be cut up into ruts, or to break through in holes; the water from below is forced to the surface, and the water from rain on an earth road can find no passage downward.

The action of frost heaves and breaks up the roadway, and renders it impassable in spring; and the common expedient of applying more gravel or stone to the surface, and rounding it up, only renders the mud deeper, and complicates the difficulties.

From Penfold's treatise on roads we quote the following:

"Next in order comes drainage. No attempt at repair must be made until great care has been bestowed upon this point—a point so desirable in road-making that any exertion in other respects will be fruitless when this is unattended to. * * * Water in a road is as canker, inwardly fretting and destroying the very principle of life. Assistance, then, must be given by the hand of skill, and the intrusive, unwelcome visitor must be shown the door.

"To effect this let the ditches be examined, and if found not to be sufficiently

below the foundation of the road, they must be cleansed and lowered, and a ready fall secured leading from the road. If the fall be slight, create, if possible, an artificial one. If the subsoil of the road contains springs, find them out, and fear not to cut well into them, laying an underdrain of tiles or blocks of chalk, or large pieces of stone or bricks, from the point of the spring into the ditch.

"If this be not done, the road in those places will be constantly sinking into holes and soft places, and consume more materials in a year than the expenses of the underdrain will amount to; but the underdrain will last for years, and the road be always sound. Outlets from the water tables into the ditches cannot be seen in too many places, and if they be not attended to, the water which falls upon the surface of the road cannot escape, and must have a bad effect.

"It will be very often seen that the lands adjoining are situated upon a higher level than the road, and when that is found water will have a natural tendency to pass through and across it. In those instances, if there be no ditch to intercept the water, there must be one made, or an underdrain along the water table, or under the foot path, formed, as before described, of chalk or stone, that the foundation may be preserved.

"When a particular piece of road is observed to be constantly heavy and in a bad state, requiring a cost of materials constantly repeated, it is situated either in that manner, or in a flat where the water cannot escape. There are very few instances in which relief cannot be afforded by drainage, and a careful observer will find how immediate the relief is, and how much wear is saved when effectually conducted, and how improved the road becomes with respect to the draught of horses."

The drainage of land for agriculture, although well understood abroad, has not been much practiced in this country, and the operation of a few tiles buried four feet in the ground, in drawing away the surplus water, always occasions surprise to those unfamiliar with it. It is perfectly established by thousands of experiments that parallel lines of two-inch pipe tiles, having a good outlet, laid at proper distance, four or more feet deep, will draw away from the soil between these lines to nearly the depth of the tiles, in a few hours, all the surplus water that it contains. The proper distance is about 60 feet, in open soil, like sand or gravel; 40 to 50 feet, in loamy or peaty soils; and 16 to 40 feet, in compact clay. By surplus water is meant all moisture that is not held in the soil by capillary attraction—all, for example, that would run out of a barrel of earth with holes in the bottom. By such tile-drains the surplus water that falls upon the field in the heaviest storms is ordinarily drained entirely off in from 24 to 48 hours, and no water is left on or near the surface an hour after the rain has ceased.

The common method of draining road beds, recommended by engineers, is to provide open ditches, or covered stone or brick drains, which we prefer, at the sides of the road, and to lay transverse drains of tiles, stone, or brick across the road connected with the side drains. The distance apart of these cross-drains must depend upon the nature of the soil, twenty feet being the minimum in compact soil.

It is evident, however, from what has been said, that a line of drains each side of the roadway, of the usual width, parallel with the road itself, must keep the pathway free of surplus water below, proper provision being made for surface drainage.

The cheapest and best material for such drains is the common drain-tiles, and we should recommend for ordinary cases those of three-inch calibre. A smaller size would be usually sufficient to carry the water, but they are more liable to obstruction than those of larger capacity. Provision should be made for the discharge of these drains, at the end of 200 or 300 feet, into a larger drain or culvert.

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Drains are rendered useless by obstruction with sand or silt oftener than from any other, or indeed, all other causes.

The difficulty is in keeping the silt or fine particles of earth out, and not of letting the water in, and the utmost care is necessary to cover the joints of tiles, so as to guard against this evil. The superiority of tile drains over stone drains consists, partly, in the closeness of their joints, by which everything but water is excluded.

If cross drains are preferred, they may, on ground nearly level, run at right angles with the road; but when the road is inclined, they should meet at the centre, and run downward out to the side drains in a V form.

For surface drainage, open ditches are usual and most convenient, their width and depth depending much on circumstances, drains of two or three feet depth being sufficient in most cases. Open drains are, however, constantly filling by the growth of vegetation, by the treading of cattle and other causes, and so are unsafe conduits to receive the water of other drains.

We have seen, too, the importance of laying the drains for the foundation at greater depths than the surface drains. It is therefore advisable to make the systems of surface and under-drainage, to a considerable extent, independent of each other in building common country roads.

In paths and streets of towns and villages it is not unusual to lay large underground sewers, deep enough to receive the under-drains, and large enough to conduct the surface water, with occasional traps and man-holes for clearing them of accumulated filth.

It is never safe to admit surface water into small drains of six inches or less without traps, as they must thus be soon obstructed.

Since the wet places along the route are usually the lowest places, it may often be found convenient to raise the road, both to render the grade easier and to keep the track dry. It is evident, if our principles as to drainage are correct, that an embankment, four or more feet high above the surface of the land at each side, will be always well drained. The action, too, of the sun and wind, in drying the surface of a road thus raised, is not inconsiderable.

Common roads are oftener opened through extensive swamps or bottoms, with wide, open ditches which have no outlets, and so are always filled with water in wet seasons. Materials for raising the road are, to some extent, thus obtained; but it is a mistaken idea to suppose that ditches full of water have any tendency to drain the adjacent soil. On the contrary, they keep it always fully saturated at least as high as the surface line of the water in the ditch.

We have urged the importance of drainage at some length, because we feel sure that in no particular, in the construction of common roads, is so much money wasted as in vain attempts to do the impossible thing of building a good roadway on a wet foundation.

We know of instances where thousands of loads of gravel have been hauled upon a low or springy piece of road, and the roadway rounded up so as to be unsafe to travel, where one-tenth of the expense applied in drainage would have rendered the road easy and safe.

In connection with the subject of the foundation of roads, it may be said that the controversies among the most famous road-makers have arisen more from their different theories and practice as to the construction of the foundation than of the surface or intermediate parts. The modes of preparing these foundations may be divided into three: 1. Roads with no artificial foundation; 2. Roads with a paved foundation; 3. Roads with a foundation of concrete.

ROADS WITH NO ARTIFICIAL FOUNDATION.

Mac Adam, who first introduced into general use in England broken stone for the construction of roads, and from whom such roads derived their popular name

of macadamized roads, insisted that neither paved nor concrete foundations are essential to the best road. He advocated thorough drainage of the subsoil and the use of broken stone of uniform size, laid in sufficient thickness upon the natural soil, as being the best possible method of construction, and he says that from seven to ten inches' thickness of the proper material is sufficient to carry anything. He contends that the whole science of road-making consists in forming a *solid, dry path on the natural soil*, and then keeping it dry by a water-proof coating of stone, which should form a hard and smooth surface for the transportation. As to the size of the stone used for roads, Mac Adam suggests that none exceeding a cube of one and a half inch, or about six ounces in weight, should be used. Subsequently he reduced this size for use on the Bath and Bristol roads to one and a quarter inch, or about three ounces weight. On examining old roads he found that the average size of the stones varied from seven to twenty-seven ounces in weight, and that the state of disrepair and the amount of expense, on the several roads, was in pretty exact proportion to the size of the material used.

In Penfold's treatise we find him advocating Mac Adam's theory of a dry, natural substratum for a foundation. Still, he adds, further on, "It perhaps may be conceded, that upon a road which is liable to great and heavy traffic, and where there are ample funds at hand to supply the expense, and in order to render security doubly sure, the practice of laying a stone foundation may be resorted to, provided a heavy coating of broken stone be always kept upon it." Mr. Thomas Hughes refers to the Brixton road, constructed by this same Mr. Penfold, as an illustration of the excellence of a concrete foundation of lime and gravel of the depth of six inches, to be covered six inches with gravel or broken stone. It would seem, therefore, that Mr. Penfold's opinions were modified by circumstances of particular cases.

In the construction of common country roads, no attention is usually given to the foundation; and if the ground be thoroughly drained, a very good road may be built upon natural soil of almost any character, if this soil be regarded only as the foundation, and not the road itself.

The common method of road-making by town and county officers, however, is to remove the large stones and stumps, plough the surface of the proposed roadway, turning the soil of soft loam, turf and all, toward the centre, thus forming a rounded bed of the softest material, and whatever of gravel or other covering is thought necessary is drawn in carts and dumped upon it, or scraped from the surface of the adjoining land. By this process there can be no good foundation. The least that can be done to build even a tolerable kind of a road is to remove all the surface soil and soft deposits of vegetable matter, till a solid foundation of some kind is reached, upon which, thoroughly drained as before directed, the roadway, composed of hard material, may be constructed.

ROADS WITH PAVED FOUNDATION.

This mode of forming an artificial foundation was introduced into England by Mr. Telford, and may be understood by the following extract from one of his specifications for a portion of the Holyhead road: "Upon the level bed, prepared for the road materials, a bottom course, or layer of stones, is to be set by hand, in form of a close, firm pavement. The stones set in the middle of the road are to be seven inches in depth; at nine feet from the centre, five inches; at twelve from the centre, four inches; and at fifteen feet, three inches. They are to be set on their broadest edges lengthwise across the road, and the breadth of the upper edge is not to exceed four inches in any case. All the irregularities of the upper part of the said pavement are to be broken off by the hammer, and all the interstices to be filled with stone chips, firmly wedged, or packed by hand with a

light hammer, so that, when the whole pavement is finished, there shall be a convexity of four inches in the breadth of fifteen feet from the centre."

It is claimed, for a foundation of this kind, that it is firmer and less elastic than the best foundation of common earth; that it will carry greater loads without damage; that the bottom stones, thus set, assist in the drainage, by allowing the water to pass through them; and that it is cheaper, even in the first construction. in cases where stones are abundant, and being more permanent, is more economical in maintaining.

It is a common practice in constructing highways in New England, especially in wet places, to cast in large quantities of stones of all sizes, such as the neighborhood affords, and cover them with a few inches of soil or gravel. This is done partly upon the idea that the stones will assist the drainage, but mainly because it is supposed they form a firm and permanent foundation for the earth, gravel, or stone covering, which forms the surface.

No idea can be more erroneous. The tendency of stones of irregular form and various sizes, near the surface, is constantly toward the surface, the larger ones working above the smaller, just as in shaking a basket of fruit the larger specimens come to the top.

"Large stones," says Mac Adam, "placed under a road and not wedged down (as in Telford's method) will invariably work up to the surface. Thus over Bresiington common, England, the whole of the original soil had been covered, at great expense, with large flag-stones and the road covering laid upon them. Their motion kept the surface in a loose, open state, till, on the road being dug up, they were found almost entirely turned upon their edges, having been acting with the force of levers upon the road, which they had made to crack and sink without the cause, at such a depth, being suspected."

In a cold country there is also the agency of frost in forcing to the surface stones lying within its reach—say four feet or less from the top of the ground—even when lying singly and in open fields. Through expansion by the freezing of the water contained in the earth, the ground is lifted, taking up with it whatever is frozen to it, and in a thaw, earth is carried under such object and thus prevents its falling back to its position. It is common in New England to see posts of wood, and even of heavy stone, in a few seasons thrown entirely out of the ground by the action of frost alone.

ROADS WITH CONCRETE FOUNDATIONS.

Concrete, composed of gravel and lime, was first used in England, having been proposed by Mr. Thomas Hughes for the foundations of roads, and the following remarks upon it are quoted and condensed from his work on roads. The use of lime concrete, although an introduction of modern times, derives its real origin from a very remote period. The Romans, in constructing their military ways, particularly in France, adopted the practice of forming a concrete foundation composed of gravel and lime, on which also they placed large stones as a pavement. This mode of constructing was so solid that in many parts of Europe the original crust of the Roman roads is not, at the present day, entirely worn down, even after the lapse of fifteen centuries.

The method practiced by Mr Penfold is described as follows:

The lime is first thoroughly ground to powder. The greatest care is taken, when the water is added to the mixture, that every particle of the lime is slaked. The bed of concrete having been spread to the depth of six inches over half the breadth of the road, the surface is then covered over with six inches of good hard gravel or broken stone in two courses, the first three inches being laid on before the concrete has become perfectly hard, in order to form a more perfect junction of this material with the concrete. In this way the stone is pressed into the concrete. The lower pebbles being thus fixed and their rolling motion prevented,

the rest of the material has at once a tendency to bind and become solid, binding being nothing more than the solidity produced by the complete wedging and fixing of every part, so that the pebbles do not move upon and rub against each other. It is claimed that the surface materials of a road thus formed become firm much sooner than when these materials are laid on the soil on any loose foundation. One of the great advantages attending this mode of construction is that good and solid roads may be thus made with materials such as round, pebbly gravel, which in any other mode of application would not be deemed suitable.

Mr. Law gives directions for making the concrete in this manner:

"The gravel should be free from clay, dirt, or other impurity, and should consist of stones and sand mixed in almost such proportions that the latter would just fill the interstices of the former. The gravel should then be mixed with the proper quantity of ground, unslaked lime—in ordinary cases five or six parts of gravel and one of lime will be found to answer—after which, sufficient water being added to slake the lime, the whole should be thoroughly and quickly mixed and immediately thrown into place and trimmed off to the desired shape, the first layer of broken or other stone being applied just when the concrete is about to set."

ROADS WITH ROUGH STONE FOUNDATION.

Contrary to the theory and practice of European engineers, the commissioners of the New York Central Park have adopted a system of constructing their roads upon a foundation of broken or rubble stone. The security of such a foundation must depend upon its depth and the form of the stone used in its construction. If laid below the frost, and of heavy angular stone, carefully placed, such a foundation, without cement, might be expected to be permanent. It would be in effect what has been described already as a paved foundation. Upon stone of this irregular form we understand is deposited a body of coarse gravel, upon which screened gravel, in the manner already fully stated, is laid and the road finished. Thus far the roads so constructed have proved satisfactory. It is a question, however, whether such a foundation, expensive as it is, is in any respect better than a well-drained foundation of sand or common soil, either of which, covered with a suitable depth of screened gravel or broken stone, is found to bear the pressure of any weight usually transported over common roads.

In the construction of railways no foundation is thought to be preferable to that of sand or gravel, kept always free from stagnant water.

SURFACE OF ROADS.

A smooth, hard surface is usually said to be desirable for a road, yet it is manifest that if the surface were as smooth and hard as glass no animal could travel upon it. Plates of iron, and slabs of stone even, are too smooth for practical use in pavement for cities. We may, however, safely aim at the utmost smoothness and hardness of surface possible in the use of broken stone or gravel as a covering for common roads.

We have said that a body set in motion would continue to move were it not resisted by certain forces, the chief of which in the case of a carriage on a highway are gravity, friction, and collision, the first of which has been already considered under the title of "Grades." We will now briefly consider the other opposing forces, friction and collision, in order that the importance of a perfect surface may be fully appreciated. Any person who has driven a wheel carriage on the smooth ice of a lake, or who has observed the power of a horse to draw loads on well constructed railways, may appreciate the difference between a good and bad surface, yet it may make the matter clearer if we look at the subject a little in detail.

FRICTION.

An ivory ball rolled over a woollen carpet is visibly and rapidly retarded in its course. It is retarded far less upon a wooden floor, and upon a sheet of smooth ice its velocity will scarcely seem to abate in a long distance. The principal force which thus retards the ball is friction, which in its application to this subject is the resistance which arises from the wheels being forced upon obstacles which break down under their weight, or when they are drawn through mud, sand, or other soft substances. The resistance depends upon the depth to which the wheel sinks, the stiffness of the mud or other substance which covers the road, and the height and breadth of the wheel—elements so variable that it is difficult to apply to them in practice even well understood principles.

It is said, however, that the resistance occasioned by friction is altogether independent of velocity. Says a writer in the Edinburgh Review:

"Experiments made on an extensive scale have established satisfactorily that when the quality of the road and of the wheels is the same, the resistance to the motion of the carriage arising from the roughness of the road will always be in proportion to the weight of the carriage; a double weight will offer double resistance, a triple weight a triple resistance, and so on. The same experiments established another consequence, materially affecting all questions respecting the work performed on roads. This result is, that the resistance to the motion of a carriage is altogether independent of the velocity of that motion, and that whatever be the speed at which a carriage moves, the resistance will suffer no change."

COLLISION.

The resistance offered by collision to the motion of a carriage is considered by Parnell as distinct from that produced by friction, although it may be difficult to define the line between the two. In general, it is the contact of the wheel with a stone or other hard substance, over which the wheel must rise in order to pass it.

This resistance is diminished as the diameter of the wheel is increased. It is less where the line of draught is upward—that is, where the power attached to the axle inclines upward—and greater when the line of draught is downward.

The injury to the road caused by these obstacles is very great. The force with which the wheel descends from the top of the stone is sufficient soon to wear a hole in the hardest road. Again, as one wheel is thus elevated the load is thrown upon the other with a sideway thrust, which tends to tear up the surface and to give again a reacting motion to the load very injurious to the track.

We see, then, that the surface of a road ought to be *hard* and *smooth* as possible, to reduce the resistance to the smallest possible amount. Smoothness is not only essential to comfort, but even more so to economy of labor, and of carriage and road wear. Carriages passing over a smooth road are not only drawn more easily, but do much less damage to the road than when the wheels strike like sledge-hammers into hollows, deepening them, and thus increasing the force of the next blow. Hardness is essential to the preservation of smoothness. A solid, unyielding foundation is one of the first requisites for a perfect road.

General Morin made experiments to show the resistance to draughts on roads of different surfaces, with the following results: Carriages on springs, drawn upon a new road covered with gravel five inches thick, required in tractive force one-eighth the load; upon a solid causeway of earth, with gravel one and a half inch thick, required in tractive force one-tenth the load; upon a causeway of earth in very good condition, required in tractive force one twenty-sixth the load; upon a broken stone road, very smooth, required in tractive force one forty-fifth the load; upon a broken stone road, moist or dusty, required in tractive force one-thirtieth the load; upon a broken stone road, with ruts and mud, required in tractive force one-twentieth the load; upon a broken stone road, with deep ruts and thick mud, required in tractive force one-tenth the load.

Gillespie says: "The surface of a road being hard and smooth, well made of broken stone, a horse can draw *three times* as much as he can upon a gravel road. Men should be stationed on a new road to rake in the ruts and keep off round stones. No large stones or coaser gravel should be placed at the bottom, for by action of frost and vibration of carriages they are sure to rise to the surface like materials in a shaken sieve, and the road will never become firm and smooth."

CONSTRUCTION OF SURFACE.

How to construct the surface of country roads so as economically to secure a hard, smooth, and durable pathway, is the practical question next to be considered.

The three kinds of material chiefly used for the surface of common roads are, 1, unscreened gravel; 2, screened gravel; 3, broken stone; 4, common earth, sand, and soil.

The word gravel is used in senses so diverse that an explanation of its meaning is found necessary in citing every different author. Webster defines gravel to be "small pebbles or fragments of stone, or very small pebbles larger than the particles of sand, but often intermixed with them," and this perhaps conveys the popular idea, while the reports upon the New York Central Park describe the screened gravel used by them as pebbles varying in size from three-fourths to two and a half inches in diameter.

The quality of the gravel is always an important matter to be considered, as it differs widely in hardness as well as form and size; the Central Park roads owing their excellence in part to the particular character of the gravel used, it being "of a hard and tenacious character, being the natural product of a species of fine-grained, compact stone, not dissimilar to trap stone, from which the best broken stones are obtained."

UNSCREENED GRAVEL ROADS.

All writers agree that, for the surface of roads, the material should be composed of stones of the same general size; yet probably on nineteen-twentieths of the extent of roads in this country, gravel is applied in the condition in which it is found in the pit, only, perhaps, the large stones being removed by picking out by hand, or by the rake in levelling.

It seems to be conceded on all sides that clean, round gravel will not pack into a solid body, the rounded pebbles which compose it sliding under the wheel and upon each other like iron balls. But gravel is rarely found clean. It is usually mixed with loam or with clay, and thus mixed there is often cohesion enough to cause it to condense into a solid mass, with the right degree of moisture. In the gravel roads of the Central Park, although the gravel is screened, so that it should be of uniform size, yet a proportion, ascertained by experiment, of some binding material is added, and the surface is finished with a layer of fine gravel, to give at once the smooth surface desired.

A writer in the Quarterly Review says: "The materials should be homogeneous in size upon a road of well-ordered materials; wheel-carriages will then pass without any jolt or shake, and consequently without that action and reaction between the wheels and stones which is the real cause of the bad state of the roads. Round gravel and round pebbles never make a tolerable road; but broken stone will combine, by its own angles, into a smooth, solid surface that cannot be affected by the vicissitudes of the weather."

Bloodgood says, in his "Treatise on Roads:" "The form and size of the stones which compose the surface stratum have a powerful influence on a road's durability. If their form is roundish, it is evident they will not bind into a compact stratum; if they are large, whether the form be round or angular, the stratum cannot be solid; and if they are of mixed sizes and shapes, though a very solid and strong

stratum may be formed at first, yet the wheels of carriages and the feet of animals, operating with unequal effect on the small and large stones, would soon derange the solidity of the stratum to a certain depth; and, consequently, by admitting rain and frost to penetrate it, accelerate its decay."

Gillespie says: "The roundness of pebbles, which form the chief part of gravel, prevents them from perfectly consolidating, except under much travel. Gravel may be too clean; it should contain earthy matter enough to unite and bind together its pebbles. But usually the gravel contains too much earthy matter, and should be sifted—the fine material being used for sidewalks. Gravel over a hard surface will be worn away rapidly. Stones for roads should be broken into angular fragments, that they may form a compact mass; no rounded stones should ever be used. No large stones should be used, for a blow from a wheel or a horse's hoof will loosen them from place, and keep the road loose and uneven. Mac Adam examined old roads, and found the expense of their repair in pretty exact proportion to the size of the materials used."

Law says: "There are two methods of solidifying the surface of a road: one by the mechanical form of the materials forming a band, the other by the use of some binding matter like earth. The preference must be decidedly given to the former. Angular stone should be thoroughly cleaned; round pebbles should not be free from other matter."

The only practical conclusion to which we can arrive, as to the construction of unscreened roads, in the light of all experience, observation, and authority, is, that they should be made as much as possible like roads of screened gravel. If proper screens are not at hand, and cannot be procured, the judgment of the road-maker, in the selection of the proper materials, must be relied on to violate as little as possible the true principles of his art.

The screened gravel roads of the New York Central Park are probably the best samples of this kind of roads yet furnished. The gravel is carefully screened through successive screens, so as to separate the different sizes, and then laid in successive layers, beginning with the coarsest, and mingled with proper binding material, judiciously watered, and rolled compactly with heavy rollers until a solid surface is obtained. But as the great expense removes them from our subject, "country roads," we omit further remarks on them from the present essay.

BROKEN STONE ROADS.

In treating of the foundation of roads we have alluded to Mac Adam as the introducer, if not the inventor, of broken stone for the construction of roads. He advocated no artificial foundation, but merely the application of from seven to ten inches of properly prepared stone to the ordinary well-drained subsoil. He insists that the stone should all be broken of nearly uniform size, and that no round stone or large stone should ever be used. Telford and other English road builders, almost with unanimity, use the Mac Adam material for the surface, whatever the foundation, and the same is in common use in this country in the construction of city and first class country roads.

Quality of the stone.—The qualities desirable for surface *metal* (as it is termed) for roads are hardness and toughness. Glass is hard, but it is not tough; and the surface of a road covered with it would be crushed into fine powder in a very short time. Toughness consists in a certain yielding of parts without their separation, as is seen in copper and iron. Stone that is hard, like flint, and that breaks readily under blows of a hammer, is not good material for the surface. The limestones are too soft to bear the pressure of heavy weights, and so are unsuitable. Granite is much used for surface material, but as one of its components, feldspar, is easily pulverized, it is not suitable for roads of the heaviest traffic. "The sienitic granites, however," says Gillespie, "which contain hornblende instead of feldspar, are good, and better in proportion to their darkness

of color. Gneiss is still inferior to granite, and mica slate wholly inadmissible. The argillaceous slates make a smooth road, but one which decays very rapidly under wet; the sandstones are too soft. In the tide-water regions south of New York, boulders or rolled pebbles must be employed." The same writer says it is the practice on the avenues of New York to place broken gneiss below and cover it with broken boulders, which it costs three times as much to break. Penfold says the trappean and basaltic rocks are best suited to this purpose, and that no material has ever been used superior to the tough basalts which are brought in ballast in ships from China and Bombay, and which have been partially used in the macadamized streets of London.

The labor of breaking stone for roads was formerly performed entirely by hand, with hammers. Machines propelled by steam are now in use, both in Europe and this country, which effect the object with great despatch. The writer has seen such a stone-breaker in operation near Boston, which crushed ordinary paving stones into pieces of proper size, at the rate of one ton in an hour, with an engine of ten-horse power and the aid of an engineer, and three or four men to throw the stones into a hopper and clear away the fragments. An English machine for breaking stone is estimated to require from one to one and a half horse power for each cubic yard broken in one hour. Gillespie estimated that a medium laborer can break by hand, with a hammer, from one and a half to two yards of gneiss, but only one-half to three-fourths yard of hard boulders, or cobble stones. This labor is often performed by paupers and by infirm persons, and by children, and so may be cheaply done; and as it is a sort of labor which may be done at any season, and taken up at leisure moments, is hardly to be reckoned at full prices. Where labor is as costly as it now is in this country, machinery must be brought more and more into use, and stone-breaking, like reaping and mowing, must be done by the power of horses or steam.

CROSS SECTION OR SHAPE OF ROADS.

The shape of the pathway of a road should be such that the travel may naturally go on all parts of it, and not be confined to the centre or any other portion; for, however hard the material, ruts will soon be worn in it by the continued tread of animals or wheels in the same line. The necessity of some convexity to promote surface drainage is apparent to all; but the evils of too great convexity, which is far more common than the want of sufficient slope, are not so manifest to a casual observer. They may be described as follows:

1. On a very crowning or convex road, as country roads are usually first made, the wheels have no even bearing on the surface. If the horse is in the centre, each wheel is constantly pressing the surface material outward, the bearing being on the inner edge of the wheel, so that ruts are worn at once; if one side is used, both wheels having the sliding tendency, carry the surface material to the ditches, and much increase the draught.

2. To avoid the sliding tendency, and to keep the carriage upright, the middle of the road and convex path is always preferred, and thus deep ruts are soon worn, and this compels the traveller to keep the same track, bringing all the wear in the same place.

3. Water fills the ruts thus worn by the horses and wheels, until it runs over toward the ditches, and thus washes gulleys in the track, or it remains, keeping the road a long time muddy, and helping to wear still deeper ruts.

4. A road too convex is thus rendered, if not dangerous, difficult to turn out upon; and when there is occasion to cross, there is the resistance of a heavy grade to be overcome.

5. Drainage of the surface is prevented rather than promoted by too great convexity. If the surface retains its even form without ruts, the water will run off at once, at a very low inclination. If a rut is formed even one inch deep,

no practicable degree of convexity can empty it towards the side ditches. The cross-section, or transverse profile of the surface of a road, is of so great influence upon the cost of repairs, and upon the convenience and safety of travellers, that we shall quote the opinions of several writers upon this subject, whose views are entitled to respect. A writer in the Quarterly Review says: "In the formation of roads one of the most prevailing faults is that of giving them too great convexity. A fall of three inches, Mac Adam says, from centre to side, is sufficient for a road thirty feet wide." Mr. Edgeworth says: "In all these schemes for carrying off water from the roads by the inclination of the ground, it seems to have escaped the attention of those who proposed them, that no lateral inclination of the ground, consistent with the safety of the carriages, would empty a rut of three inches deep. So far is this from being the case, that even down a moderate slope, where any dirt remains upon the roads, the water will be obstructed. When the roads are exposed to sun and wind, the effects of heat and ventilation are more powerful than any surface drainage that could be accomplished for drying a rough road." Law says: "The majority are averse to a road being much curved in cross-sections. The only advantage in crowning the surface of a road is to facilitate surface drainage. Now the only reason why carriages use the centre of the road in preference to its sides, is on account of the rounding form, as it is only there the carriages can stand upright. Mac Adam thinks that more water actually stands upon a very convex road than on one which is reasonably flat. The wear of roads is greater when crowned excessively. The sliding and scraping motion is very injurious. Many accidents and much danger have arisen from the practice of forming roads with excessive convexity. * * Generally speaking, the cause of bad roads is their imperfect transverse form, and the improper manner in which the road materials are used. Whatever the measures adopted for repairs, the road must be brought to the proper form of section before much improvement can be expected. This should be done by cutting down those parts that are too high, and raising the depressed parts. The course to be pursued is that of *lifting* the road—that is, loosening and turning the surface to about four inches depth, removing the improper materials; after which, fresh materials should be laid on thin, never exceeding three inches at one time, and ordinarily not more than two inches. When the surface is thin, and new materials are to be added, the surface should be just loosened, so that the new may be rapidly incorporated with the old material. The best time for repairs is in a wet time."

On this subject Mr. Mac Adam says, in giving evidence before a committee of the House of Commons: "I consider a road should be as flat as possible, with regard to allowing the water to run off it at all, because a carriage ought to stand upright in travelling as much as possible. I have generally made roads three inches higher in the centre than at the sides when they are eighteen feet wide. If the road be smooth and well made, the water will run off very easily in such a slope." And in answer to the question, "Do you consider that a road so made will not be likely to wear hollow in the middle, so as not to allow the water to stand, after it has been used for some time?" he replies, "No; when a road is made flat, people will not follow the middle of it, as they do when it is made extremely convex. Gentlemen will have observed that in roads very convex, travellers generally follow the track in the middle, which is the only place where a carriage can run upright, by which means three furrows are made by the horse and the wheels, and water continually stands there, and I think that more water actually stands upon a very convex road than upon one which is reasonably flat."

On the same subject, Mr. Walker, before the same committee, says: "A road much rounded is dangerous, particularly if the cross-section approaches towards the segment of a circle; the slope in that case not being uniform, but increasing rapidly, from the nature of the curve, as we depart from the middle or vertical

line. The over-rounding of roads is also injurious to them by either confining the heavy carriages to one track in the crown of the road, or, if they go upon the sides, by the greater wear they produce, from their constant tendency to move down the inclined plane, and the labor of the horse and the wear of the carriage wheels are both much increased by it."

Law says: "The drainage of the surface of the road is then the only useful purpose which will be answered by making it convex, and even this in but a very imperfect manner, in consequence of the irregularities and roughness which we find in even the best roads. The surface of a road is much better drained by a small inclination in the direction of its length, than by a much greater transverse slope." The same writer sums up the matter thus: "While, then, the advantages attending the extreme convexity of roads is so small, the disadvantages are considerable; on roads so constructed, vehicles must either keep upon the crown of a road, and so occasion an unequal and excessive wear of its surface, or use the sides, with a liability of being overturned. The evidence of coach-masters and others, taken before the committee of the House of Commons, quite bears out the views here taken, and shows that many accidents and much danger have arisen from the practice of forming roads with an excessive amount of convexity." Mr. Law recommends, as the best form which can be given to a road, that its cross-section should be formed of two straight lines inclined at the rate of about one in thirty, and united at the centre or crown of the road by a segment of a circle having a radius of about ten feet.

Telford, whose authority is perhaps as high as any in England, says: "A road should fall transversely from the centre to the water-tables at the rate of one in twenty-four along flats and level ground, and sharper in proportion as declivity increases. It is made rounder, or the section is sharper, down a hill, that the water may be more quickly carried off to the sides into the water-tables, for if not quickly carried there it will run longitudinally down the hill, to its great injury." The excellence of Mr. Telford's roads is said to consist principally in the smallness of their convexity. The roads in Sweden are described as being very fine. They appear to the eye to be perfectly flat, but upon trial, by the spirit-level, there is a slight degree of convexity.

The roads in Central Park are generally less convex than Mr. Telford's, most of them having a fall equal only to one in thirty-six or forty. The following table, from an official report in 1866, to which we have added the last column, showing the proportion of the fall, gives the rate of convexity of all the roads which had then been constructed, with their length in miles and feet:

	Miles.	Feet.	Crowned in middle.	Crowned, one in—
			Inches.	
Roads 60 feet in width	1	768	9	40
Roads 50 to 55 feet in width		3,528	9	33 to 36
Roads 45 feet in width	2	4,868	6 to 9	30 to 45
Roads 40 feet in width		2,432	6	40
Roads 33 feet in width	3	3,068	6	34
Roads 30 to 32 feet in width		2,524	5	36 to 39
Roads 20 to 25 feet in width		353	5	20 to 30
Roads 16 feet in width		1,110	4	24

Even the greatest of these degrees of convexity appears very small when compared with the turnpike highways usually built in this country in the rural districts, where the plough and the scraper are used to heap together the natural surface soil into the shape, without the solidity, of a proper road. The town authorities see these very convex roads at once crushed down by the travel into

flat or concave surfaces, alternately sand or mud, according to the season, and constantly endeavor, by vainly increasing the convexity, to secure the desired firmness. A convexity of one in twenty-four will seem to such observers as quite insufficient. If, however, we carry out the idea of a well-drained, solid foundation, on which is placed a thoroughly compacted mass of hard material, whether gravel or stone, always completely drained with such arrangements that no water remains stagnant in them, even the low grades of the Central Park—one in forty—will be found sufficient.

The following has been found to be a very good general rule, and we recommend it for adoption: Divide a road forty feet wide, so that the carriage-way shall be twenty-six feet wide, and the sidewalks seven feet wide each. Make the middle of the carriage-way six inches higher than the gutter, and just level with the nearest edge of the sidewalk. The sidewalk may slope toward the road one inch in eight feet. The slope of the carriage-way, as above, being six inches in thirteen feet, is equal to one in twenty-six. The same slopes may be maintained for any width. (See Fig. 1.)

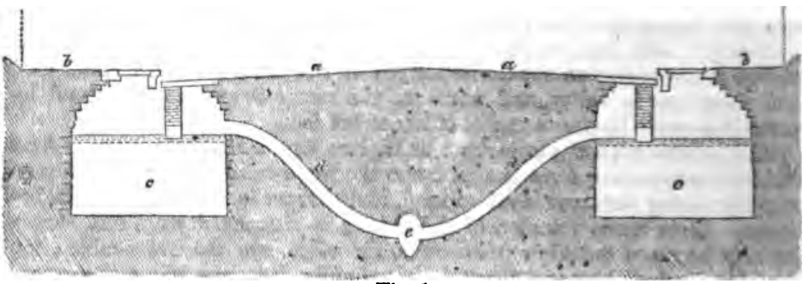

Fig. 1.

Street forty feet wide.—*a a*, slope of roadway, one in twenty-six; *b b*, slope of sidewalk, one in ninety-six; *c c*, catch basins; *d d*, overflow from catch basins; *e*, sewer; *f f*, agricultural drain tiles, laid six feet below the surface. In many cases one line of drain-tile, laid under the middle of the roadway, will be sufficient to secure a dry and firm road.

WIDTH OF ROADS.

We speak of the width of a road in two quite different senses—first, as the extreme breadth between the fences, and, secondly, as that of the travelled pathway. Commissioners, select-men, and others, officers authorized to establish highways, always mean the limits of land thus devoted to the use of the public, and within these limits the public have the use of the land for the purposes of a road, the land-owner still remaining owner of the soil, and to make use of it for any purpose not inconsistent with its public use for a highway. By the laws of New York, all public roads are required to be three rods wide, and turnpike roads to be four rods wide. In Massachusetts, public roads are usually laid out from thirty to sixty feet wide, and so in New Hampshire. In places liable to obstruction by snow, it is necessary to allow greater width than in other positions, because the snow usually falls in drifts by the fence, on the side of the road from which the wind blows, and in great storms, if the breadth is small, fills the road entirely full.

The pathway of a road ought to depend, for its width, upon the character of the traffic it is expected to accommodate. The least width convenient for carriage travel is about sixteen feet, giving room for carriages to pass each other. For ordinary town roads a proper width is twenty-four to thirty feet. By a New York statute, twenty-two feet of the four rods on turnpike roads are to be laid with stone.

Gillespie gives the width of the highways in various countries, as gathered from different authors, as follows:

In France three classes of roads are constructed—the first of these the most important, which are sixty-six feet in width, of which twenty-two in the middle are stoned or paved; the second, fifty-two in width, of which twenty feet are stoned; and the third, thirty-three feet in width, with sixteen feet stoned. By "stoned" we understand covered with broken stones, or macadamized.

In England, the prescribed width for turnpike roads near populous towns is sixty feet, and the limits of by-roads and for carriage roads twenty feet; for horse roads eight feet, and for foot-paths six and a half feet.

Telford's Holyhead road, a model road for a hilly country, has the following width between the fences: Thirty-two feet in flat ground; twenty-eight feet when there are side cuttings less than three feet deep, and twenty-two feet along steep ground and precipices. The United States Cumberland road has eighty feet wide cleared, the road itself being thirty feet. Broadway, New York, is eighty feet wide between the buildings, the carriage-way being forty-two feet wide.

DRYING BY SUN AND WIND.

One object in "clearing" or cutting away the timber in roads through a new country is to admit the sun and air, in order to keep the surface dry, and this is a matter which requires attention both in constructing and maintaining all highways. It is quite common to see country roads, legally established sixty feet wide, so narrowed up by trees and large bushes as completely to shade them, even at noonday. Willows are often planted for fences through low grounds, and suffered to grow up and overhang the pathway. The effect of the shade is to prevent evaporation, and to keep the surface always wet and soft, and to cause the road to be cut up into deep ruts at all seasons.

Low-headed trees, like willows, and tall bushes, like alders, are worst of all, as they exclude air as well as sunshine, while lofty trees, like elms, may furnish a grateful shade to the traveller in the heat of the day without shutting out the free circulation of the air, or sheltering the road to its harm.

CUTTING AND FILLING.

As these operations are the most expensive part of the process of constructing roads, the route should be carefully selected to avoid their necessity so far as possible, as well as to furnish the requisite material for the embankment.

When cutting and filling are both necessary, the amount of each should be accurately calculated in advance, so that the quantity of earth removed from the cutting shall just form the embankment, so as to leave nothing to be carried from the line of the road. The line of section which effects this object is sometimes called the *balancing line*. The slopes of cutting should always, for the sake of stability, be more gentle than the angle of repose of the material of which they are composed, but for greater security, and for the admission of sun and air to keep the road in order, it is better to make the inclination, in sand, from two to three feet horizontal to one perpendicular. In gravel and other earth the usual practice of giving one and one-half foot horizontal to one perpendicular has been found to answer very well.

The angle of repose, or natural slope, of different kinds of earth, as observed and recorded, is as follows:

1. Fine dry sand	35° 30′	1.40 hor.	to	1	per.
2. Gravel	37	1.33	"	1	"
3. Common earth, fine and dry	46 50	0.94	"	1	"
4. Common earth, slightly damp	54	0.73	"	1	"
5. Earth the most dense and compact	55	0.70	"	1	"

Retaining walls of greater or less height are often built, especially where land is valuable and stone abundant, at the foot of the slope, to lessen the inclination and the breadth of land occupied.

These walls should be built with an inclination backward, or battering, as it is termed, about one-tenth of the vertical height in ordinary cases, and special care must be taken, by drainage, to prevent water from penetrating the soil supported by the wall. Figure 2 shows the method of constructing a retaining wall of split stone.

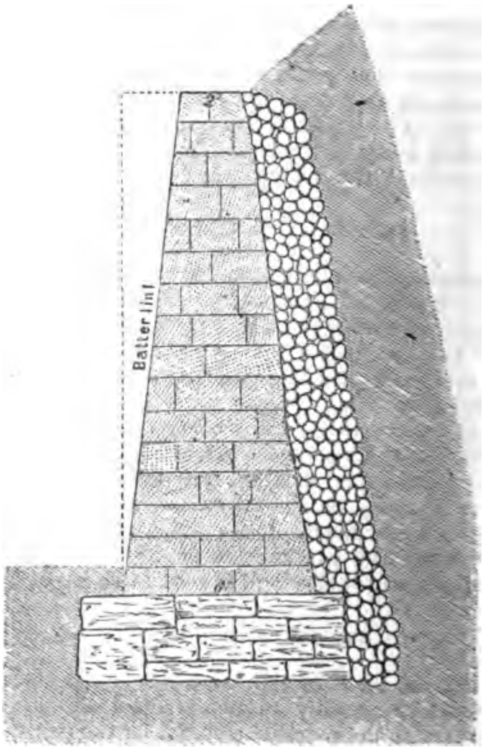

Fig. 2.

In running along rocky, precipitous grounds, the road may be formed in the manner shown by Fig. 3, which is a section of part of the Holyhead road, as executed by Mr. Telford. Here the retaining wall is built in such a position that a horizontal cutting of ten feet wide, and the space between the wall and the cutting filled in with the materials derived from the latter, form the roadway.

In filling in behind a retaining wall such as this, the material should be filled from the wall towards the solid ground; and if the ground on which the filling rests be also stepped, the filled proportion will have less tendency to slide, and the pressure on the wall will be diminished.

In side forming, when the case does not demand the above mode of treatment, the foundation of the portion that it is to be embanked should be cut in steps, as in Fig. 4, where (*a*) is the general slope of the land, (*b*) the portion removed, and (*c*) the form and position in which it is ultimately placed, (*d d*) being drains.

In forming embankments the best mode is to proceed by shallow layers of the materials. Each layer should be so placed as to form a concave surface, and when the embankment is carried up to a retaining wall the materials should be

well rammed in each layer before the next is added. In this way an embankment of the greatest solidity will be obtained, (Fig. 5.)

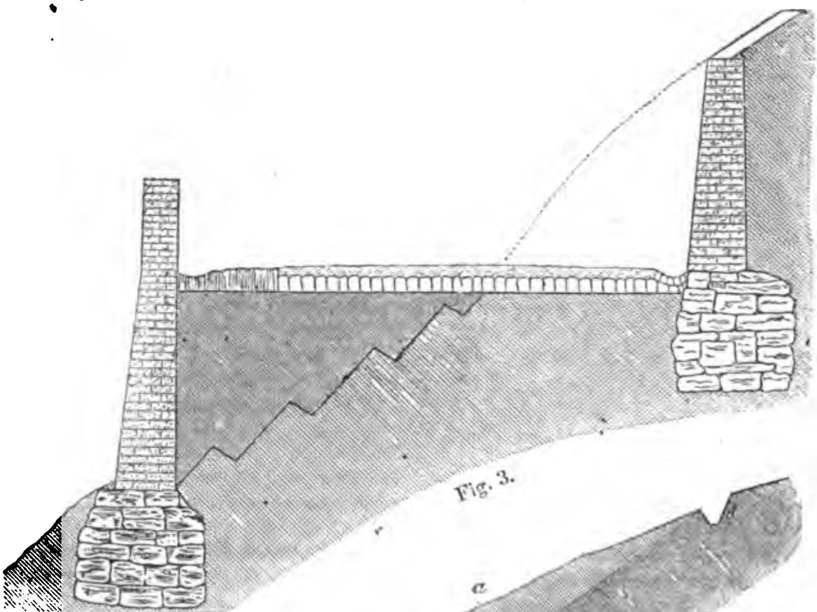

Fig. 3.

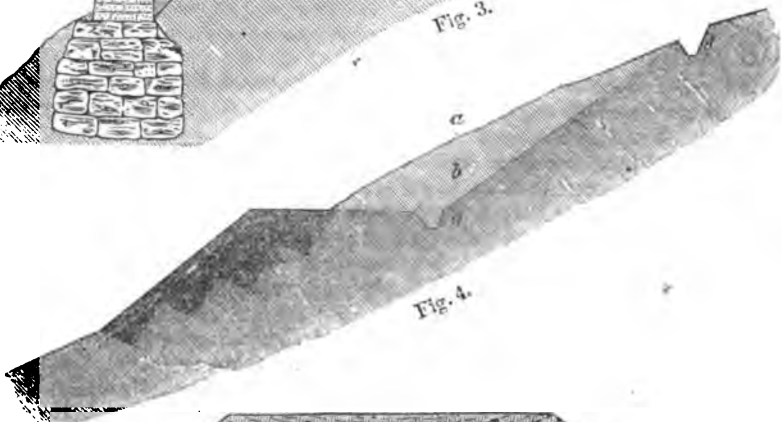

Fig. 4.

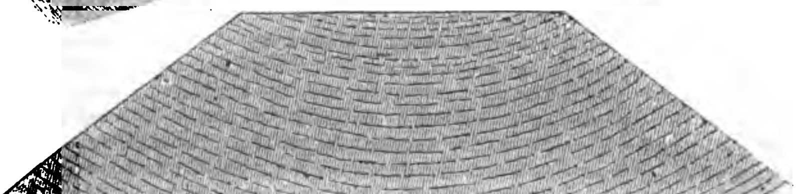

Fig. 5.

Another mode followed in railway works is to form the embankment to half its height, and after that is consolidated, to complete the other half. But a preferable mode is to run forward the two sides of the embankment to their full width, leaving a central valley to be filled in at some distance in the rear. Alteration in form is less likely to follow this mode of construction than that in which the embankment is formed to its whole height at once. The first operation in commencing to form a cutting or embankment is to cut the turf from its site, and lay it aside for covering the slopes. In all such works the slopes should be dressed to their intended face as quickly as possible after they are formed, and covered with the turf; or when there is no turf, they should be tilled and sown down with grass seed.

TRANSPORTATION OF MATERIAL.

The cost of moving earth depends upon the character of the soil, the distance, and the wages of labor. We have not space to attempt more than to give a few hints as to the best methods of conducting the operation. The amount of labor necessary to loosen and move any given quantity of earth depends very much on its hardness. In loose sand and vegetable mould a shoveller can do his own work without the aid of a pick-man. In compact earth two shovellers will need the aid of one pick-man. In ordinary clay two shovellers will need from one to two pick-men, while in hard clay two shovellers will require three or four pick-men. A shoveller can throw over about sixteen cubic yards of earth per day. He can load into a cart about ten cubic yards of hard gravelly earth; of loam, about twelve cubic yards; and of sandy earth, about fourteen cubic yards. In working a cutting, the men cannot be economically placed nearer than one in six feet. A shoveller will fill a barrow in about the same length of time required by a wheeler to wheel a full barrow 100 to 120 feet, and return with it empty. A foot rise in a wheeling path is considered equivalent to sixteen additional feet of horizontal distance. Various estimates have been made of the comparative cost of moving earth with barrows and horse-carts; but such calculations, to be of much practical use, involve the necessity of more space than is allotted to us here.

REPAIRS OF ROADS.

It is even of more importance that the people should know how to maintain and repair existing highways than how to construct new ones. The roads in the older States are generally already permanently established, and their extent is a hundred fold greater than that of roads in process of construction at any time. It was estimated that in 1862 there were 60,000 miles of highways in the single State of New York. Again, new roads are usually constructed under the direction of a higher and more skillful class of officers than those who have charge of the old; and, finally, it requires more skill judiciously to reform and reconstruct roads badly laid out and badly built than to make them good in the first instance.

The old system.—By the present statutes of Massachusetts, which represent the general system of maintaining highways throughout the country, all public streets, roads, and bridges are required to be kept in repair by the cities and towns in which they are situated, unless there is some special exception by law. Each town is required to vote and assess such terms, "to be paid in labor and material," as are necessary, and assessors are required to assess the same upon the inhabitants. The towns are usually divided into several highway districts, and a surveyor is elected or appointed to each district, and to him is assigned a list of the persons taxed, and the amount, respectively, of their taxes. The surveyor is required to give seven days' notice of the times and places he shall appoint "for providing materials and working on the highways and townways; and each inhabitant shall have an opportunity to work thereon, in person or by his substitute, or with his oxen, horses, cart, and plough, at the prices which the town shall affix to such labor, to the full amount of the sum at which he is assessed;" but he may, if he prefers it, pay his tax in money, which the surveyor will then expend according to his own judgment. No one who has once witnessed the process of "mending the roads" in a small New England country town, needs any argument to convince him that a system more ingeniously devised to accomplish nothing was never invented. The surveyors, in the first place, are usually elected at the town meetings, and, as the office of surveyor is of no pecuniary profit beyond mere day wages, persons of peculiar skill, could such be found, would not usually accept it. In fact, the farmers of the district take their turns in the office, any respectable man being deemed fully competent.

Often some citizen who lives on a road out of repair seeks the office, and is elected, and takes the opportunity to expend most of the tax for the year on his own road, and leaves the rest of the district to be attended to in the future. The surveyor selects, not the season when repairs are most needed, but that which is most convenient for himself and his brother farmers, after their spring work is done, or after harvesting, and notifies every person assessed to come and work out his tax. As the citizens in town meeting fix the prices to be allowed for the labor of men and animals in thus working out the taxes, it is usually fixed at the highest prices which the best men and teams could command, and often much higher, every voter who intends to "work out his tax" having a direct interest to fix a high price, and they constitute a large majority in town meeting. The time appointed "for working out the highway tax," as it is rightly termed, arrives, and at eight o'clock a. m. a motley assemblage gathers, of decrepit old men, each with a garden hoe on his shoulder; of pale, thin mechanics from their shoe shops, armed with worn-out shovels; half-grown boys, sent by their mothers, who, perhaps, are widows; with perhaps the doctor, the lawyer, and even the minister, all of whom understand that "working on the road" does not mean hard labor, even for soft hands. The farmers bring their steers, great and small, with the old mare in the lead, with a cart; and the Irishman drives up with his rickety horse-cart and the mortal remains of a worn-out railroad horse, to do his part. The only effective force on the ground consists of two or three yokes of oxen and a half-dozen men hired by the surveyor with money paid by non-residents, or men whose time is of too much value to themselves to be wasted on the road. Here is the surveyor, who never held the office before, and who knows nothing of road-making or of directing a gang of hands. The work must go on in some way. The roads are soft and full of ruts, or rough with protruding stones. The stones must be covered, and the road rounded up into shape. The cattle are all put to the big town plough, which is set in at the side of the road; the boys ride on the beam, and the drivers put on the lash, and the gutters, half filled with the sand and soil and leaves of a dozen seasons, are ploughed up, the shovel and hoe men waiting very patiently for their turn to work. The teams then stand idle; and this mixture, more fit for the compost heap than anything else, is thrown upon the road, and finally levelled and smoothed by the old men with their hoes; and thus the road is mended. This is not an exaggerated picture of "working on the road" in many small towns. The occasion is regarded rather as a frolic than as serious labor; the old men tell stories to an audience always ready to lean on their tools and listen. The youngsters amuse themselves by all sorts of practical jokes, among which is the favorite one of overloading the carts, when any carts are used, so as to stick the teams.

This system of furnishing labor instead of money is no doubt a relic of the feudal system, under which the tenants were bound to furnish specific service of various kinds, and among the rest, to maintain roads suitable for the passage of troops for their lord. The objections to it are manifest.

Poor and rich towns execute their duty of maintaining roads very unequally. One town has a just pride in its good roads, while an adjoining town neglects them. The surveyors or overseers are usually entirely incompetent; they are changed at every annual election, and they receive no adequate compensation for services requiring skill.

Finally, this system operates very unfairly upon those who pay their taxes in money, inasmuch as they pay the full price of a day's work, which others pay in labor of very little value. In Massachusetts, and in many other States, towns have the right to raise and collect money to be expended for repairs of their roads; but the short-sighted policy of paying in labor is usually sustained by the popular vote.

In some portions of the country the repairs of roads are given out by contract,

generally to farmers residing on the line. Thus those most interested in keeping any piece of road in good repair have an opportunity of making a contract so to do, and better and cheaper attention is secured to the prevention of damages to the highway, as the contractor soon learns that prevention is cheaper than cure. This plan, therefore, is a great improvement on the common system now in use.

PROPOSED SYSTEM.

The whole system of election of surveyors at town meetings, and receiving labor instead of money, should be abolished, and a competent roadmaster should be appointed for each town, who should be held responsible for maintaining the roads always in good condition, and who should employ the labor and expend the money necessary to do so. In a few towns in Massachusetts this plan has been adopted, with great economy and success. The method is to appoint a permanent superintendent of roads, and to purchase such oxen, horses, and implements as may be necessary, and keep them at the public expense. A small force, such as may be constantly employed to advantage, may be hired by the year, and laborers by the day or month may be added as occasion may require.

The town of Waltham, ten miles from Boston, may be cited as an instance in which the plan now recommended has been fairly tested. There are in the limits of the town fifty-one miles of public ways, and for nine years they have been under the charge of the same superintendent.

The annual expenditure for repairs of roads and streets, including sidewalks throughout an extensive village in that town, for seven years up to 1865, was $3,357; and it is an admitted fact that no town in that region has highways so uniformly good as Waltham.

In 1865 the town of Brookline, a little nearer Boston, appointed a committee to report upon the subject of its roads, which had been managed under the old system.

The committee investigated the Waltham system, and recommended it for adoption in Brookline. They state, in their printed report, that the above rate in Waltham "is less than one-fourth the cost per mile of the repairs of the Brookline roads; and, in our opinion, the material is no better, and the travel quite as destructive as in Brookline, though the subsoil on which the road-bed rests is generally better in Waltham than in Brookline."

Mr. Carter, the road superintendent in Waltham, thus describes the method so successfully employed in that town:

"The town owns three good horses, with carts, snow-ploughs, tools, &c., valued, at present prices, at $1,200. A competent person is appointed to take charge of the work, heretofore at a salary of $600 per annum. His duty is to manage the teams, and direct the men, &c. There have been usually eight workmen employed in the summer months, and six during the winter, heretofore at wages varying from $1 to $1 12½ in summer, and 60 cents to 75 cents in winter. Most of the time in winter is spent in digging gravel preparing it for use, and drawing it to places of easy access, so that during the summer season a street or way can be speedily and neatly repaired. The preparation of gravel in winter I consider a very important feature in our success.

"During the short days of winter the workmen can excavate and prepare more road material than during the hot days of summer, and the stuff is ready for instant use, so that a spot needing repair can be mended before it becomes very bad from continued wear.

"In early spring, as soon as the frost is fairly out of the ground, the workmen go over the roads with picks and hoes, filling ruts, cleaning out drains and water-courses, and picking off the loose stones. Any bad spot is noted, and as soon thereafter as practicable those places are mended. From April to December, at intervals of about six weeks, the workmen pass over all the roads and streets,

and pick up and remove all the loose stones or rubbish found thereon. During the very hot weeks of summer it is so managed as to employ the men about culverts, or other similar work, so as to relieve them from the very severe labor incident to other work connected with the department."

The committee add the following judicious suggestions:

"We should recommend that a larger force, in proportion to the number of miles of road, be kept in Brookline than has been employed in Waltham, in order to insure constant care over all the roads."

The importance of constant oversight and care in "keeping up a road" cannot be overrated. This is a very different thing from "repairing a road," though the two are often confounded. By the former a road is always kept in good condition; by the latter it is only in good condition at intervals, being part of the time unfit for travel, by reason of the new materials in excessive quantity, and a part of the time worn into ruts and hollows, which increase in geometrical ratio by the heavier blows of wheels falling into them.

"A road kept in the best condition receives least injury from travel, and therefore requires the least expenditure for its maintenance.

"Supposing the road to be in good condition—that is, in proper shape and free from holes, ruts, mud, and dust—it requires the daily attention of permanent laborers to keep it so, by removing the result of the daily wear of the materials, whether in the shape of mud or of dust; and by constantly adding, in small quantity, new materials to replace those lost by the wear."

It is a common mistake among road superintendents, as among physicians, to doctor the symptoms rather than the disease. The first inquiry, in both cases, is as to the cause of the difficulty. Why does the road need repair? Is it too wet; or is it sandy and loose; or is it rough, uneven, or stony? If too wet, as has been said in reference to constructing roads, the surplus water that causes the wetness must be in some way disposed of. This water may either fall directly upon the road in rain, and be retained there, because the surface is uneven, or is of a clayey or muddy character, or it may run upon the road from higher ground, or it may press up from springs or from stagnant water below.

If the road be wet merely from rain falling upon it, and is too uneven crosswise or too level lengthwise to free itself from the water, the grades must be changed by forming the pathway so as to give a regular fall of about 1 in 26, and, if possible, a longitudinal grade should be also created of at least 1 in 200, as advised for new roads.

Usually it will be found that a road which remains wet merely from rain that falls upon it, has its surface composed of loam or clay, or other soft substance. The true remedy in such case is to remove the soft earth and replace it with proper material, as recommended for new roads. It is useless to heap good materials upon a soft and spongy foundation. A mass of gravel may carry the travel for a short time, but soon the road will begin to quake and tremble under the wheels, and by and by will be cut through and rendered worse by what has been added.

If, again, the wetness be from water pressing upward from below, consider the source from which it comes. If there are ditches on each side filled with water nearly to the level of the surface of the road, the pathway can never be kept dry. But two courses remain, either to draw off the water from the ditches, or to raise the road so that it will drain itself.

In extensive swamps it may sometimes be difficult to drain the water away from the ditches; but frequently the cheapest course will be to adopt the system of drainage as before advised. It is very much less expensive, in most cases, to draw away the water by drainage than to fill up the roadway enough above the water line to make the path always dry.

For filling up through wet places, sand or loose gravel is best for the founda-

tion, as they absorb less water than other materials. The road itself and its surface are to be built in the same manner as with new roads.

APPLICATION OF MATERIALS.

The practice of laying upon the surface of an old road a large quantity of stone or gravel at once, is disapproved by all the best road-builders, unless, indeed, the repairs be equivalent to building an entirely new road, in which case the rules given for constructing roads will apply. The effect of this practice is well described by Penfold, and is well understood by city superintendents. The remarks apply especially to broken stone and large gravel; but the operation is much the same when fine gravel is thus applied, especially if it is unscreened and contains pebbles of different sizes: "When a thick coat is laid on, the destruction of the material is very great, before it becomes settled or incorporated with the road. The stones will not allow each other to be quiet, but are continually elbowing one another, and driving their neighbors to the right and left, above and below. * * * It is one of the greatest mistakes in road-making that can be committed, to lay on thick coats of material, and, when understood, will no longer be resorted to. If there be already substance enough in the road, which, indeed, should always be carefully kept up, it will never be right to put on more than a stone's thickness at a time; a cubic yard, nicely prepared and broken as before described, to a rod superficial, will be quite enough for a coat, and if accurately noticed, will be found to last as long as double the quantity put on unprepared and in thick layers. Suppose it necessary to increase the substance of the road, and it is intended to apply materials for that purpose, and not merely to make good the wear and tear, it should be done in like manner by thin coats. As soon as one is embodied apply another and another, until the desired amount is obtained, but by no means put the whole thickness on at once. When that is done, the road remains in a loose, unsettled state for a tedious length of time, rendering the draught distressingly heavy and annoying to the public, with a great loss of material. Besides which, the sections will be found, when the material is at last embodied, very imperfect. The wheels will have followed each other in a line, causing ruts and irregularities, and the surface will present any thing but a true and even appearance."

Law, an English engineer of much reputation, says: "It is certain that more roads are spoilt from having too much material put on them, than there are from having too little. Roads should be always under repair; every road should be divided into lengths, on each of which an intelligent laborer, who thoroughly understands his business, should be placed, to attend constantly, and at all times, to the proper state of the road, for which he should be responsible. This office would consist in keeping the road always scraped clean and free from mud, in filling any ruts or hollow places, the moment they appeared, with broken stones, which should be kept in depots formed on the sides of the road, and one of which, holding thirty cubic yards, should be provided in each quarter of a mile. Each man should be provided with a wheelbarrow, shovel, pickaxe, and scraper. Additional laborers could be engaged at times when more work is required. Those who have tried the two methods find it vastly cheaper to prevent a road from getting out of repair, than it is to restore it again to a proper state. Not only should the mud be carefully scraped off, but, in dry weather, the roads should be regularly watered, not alone on account of the passengers, but for the good of the road. Scrapers are indispensable for preserving the roads in a proper state and free from mud."

Professor Mahan, in his "Elementary Essay on Road-making," says: "The repairs should be daily made, by adding fresh material, upon all points where hollows or ruts commence to form. The surface on which fresh material is spread should be broken by a pick to the depth of half an inch to an inch, and

the fresh material well settled by ramming. The importance of keeping the road surface at all times free from an accumulation of mud and dust, and of preserving the surface in a uniform state of evenness by the daily addition of fresh material, wherever the wear is sufficient to call for it, cannot be too strongly insisted upon. Without this constant supervision, the best constructed road will, in a short time, be unfit for travel; and with it, the weakest may at all times be kept in a tolerably fair state."

Lifting.—By lifting is meant loosening, by means of a pick, the old surface of the road where new materials are to be added, so that the old and new materials may be incorporated into a solid mass. If this is neglected, and new materials be applied to the hard surface of the old road, it is placed between the wheel and the old surface, as between two mill-stones, and ground to powder, making mud and dust before becoming solid. On many common roads there are large stones fast in the path, often making one side of the road higher than the other, and rendering the way not only heavy for draught, but uncomfortable and dangerous. The wheel strikes a stone on one side, throws the weight of the carriage upon the other wheel, grinding a hole into the rut; and then leaving the stone, the wheel strikes the ground, creating another hole, and so the whole surface is broken up. The common treatment of such places is to cart on a large quantity of material to cover up the stones. It is hardly possible in this way to secure a fine surface. The spots above the stones will be crushed away by the wheel, and the holes, having a greater depth of soft material, will yield more than the rest, and the road will soon return to its first estate. The only proper mode of procedure is to remove the stones, break up the whole surface with a pick, and make a properly shaped foundation. Then lay on the proper material as before directed, and it will at once be incorporated into a solid mass, with the smooth and hard surface desired.

When broken stone is to be used for the repair, the stones thus removed furnish the most convenient material, so they may be broken by hand on the spot, and the freight of it thus may be saved.

On hilly roads it is particularly necessary to open or lift the surface before applying new material, because such material has a constant tendency to slide downward by the action of the wheels, and to wash away by the rains; and, as it is necessary to have the road more convex on hills than elsewhere in order to carry off the water, there is an increased tendency of the surface material toward the ditches.

Loose stones.—A very important point, both in economy and comfort, is the constant attention that removes a stone the very day it first appears on the surface. Loose stones occasion great injury to the road. On being struck by a wheel, or the hoof of a horse, they act like a stone-hammer in breaking up the surface. Not only is the stone driven into the path so as to form a hole, but when a wheel strikes and rises over it, as before observed, the load is thrown upon the other wheel, and a depression is also made there, and a hollow once began is rapidly increased, each wheel falling into it, striking harder, the deeper it becomes. The injury to carriages from these shocks is very great; and they are a great annoyance to travellers. A loose stone is even worse than a fast stone, in occasioning horses to stumble, and a small stone almost as dangerous in this respect as a larger one.

Workmen should go over the road often enough to remove every stone as soon as it is loosened, or thrown upon the path. No labor expended on the road is more profitable than this of promptly attending to these little matters, and thus resisting the beginnings of evil.

Scraping.—On the surface of even the best roads there are deposits of various kinds, which in wet weather form mud, and thus not only impede the wheels of carriages but retain moisture for a long time upon the face, forming ruts and saturating the pathway, and working downward to the foundation. These de-

posits usually in dry weather become dust or loose sand, and do not pack so as to form a hard surface. As often as there is occasion these substances should be scraped off, as is practiced in all city streets, and carried to the compost heap for manure. This is particularly necessary when new material is to be added, as stone or gravel applied upon soft substances of this kind will sink at once to the bottom of it, and the mud and dust will remain, or if it be in sufficient quantity the new material will mix with it and increase its depth.

By thoroughly scraping off the mud, and then lifting the solid surface thus exposed with the pick, the new material will be at once incorporated with the old, and the desired smooth and hard track will be secured.

Spreading the materials.—This may seem perhaps a very trivial matter upon which to give specific directions, but much more depends upon properly spreading the materials than a casual observer would suppose. The common method of mending roads is to shoot down a cart-load of material upon the spot which seems to need repair, and another and another at short distances apart till the requisite amount is procured, then with hoes or shovels a portion is thrown each way, the main body remaining where it was first placed. All who have travelled over roads thus repaired will remember that the surface is almost always undulating, the parts where the heaps of gravel or stone were laid remaining more solid than the rest. It is almost impossible to spread material from heaps formed in this way so as to form an even surface. The best mode is to deposit the material in heaps a little one side of the pathway, and then with a shovel scatter it evenly, as if sowing grain, over the surface. In this way an even coating may be given over the whole, and a uniform section may be formed.

Watering roads.—A certain degree of moisture is beneficial to all common roads, independently of the object of protecting the traveller from dust. On roads prepared with stone or gravel, especially if the gravel be unscreened, in a very dry time the pieces of stone on the pebbles become loosened, and the crust of the surface is broken up, thus rendering the draught heavy and increasing the pulverization and wear of the track. The dust thus created is blown off by the wind, or must be scraped off in the form of mud. A moderate, occasional sprinkling, by means of a water-cart, will very much tend to the preservation of the road, and on roads of great travel prove a great saving of money. The introduction of the water-cart for the purpose may be considered one of the greatest of modern improvements in the preservation of roads. Good judgment, based on careful observation, however, is necessary to regulate the quantity of water applied. Too large a quantity of water will tend to form mud, which is a greater evil than the dust of a dry season. To keep the surface slightly damp, and yet to create no mud which will adhere to the wheel, is what is desired.

Width and form of wheels.—Since those who have charge of highways have rightfully great influence in procuring proper legislation upon the subject of the proper use of them, it may be proper to speak briefly of the comparative effect of broad and narrow wheels upon common roads. Penfold says: "Injurious action upon the surface of the road diminishes progressively as the width of the felloe increases, provided the weight be not excessive. A wheel may so increase in width as to act as a roller or compresser, and within certain limits the heavier the roller, the more effectual it is in producing the desired effect, viz., compression."

For such reasons, the statutes of many States make discrimination as to the toll to be paid on turnpike roads by carriages with broad and narrow wheels. The New York turnpike laws provide that carriages with six-inch tire shall pay only half the usual tolls; those with nine-inch tire one-fourth, and those with twelve-inch tire, none at all. Penfold has made calculations in relation to roads in England, which agree with these proportions.

Narrow wheels are cheaper than wide ones, and are of lighter draught on roads of hard surface, and are therefore likely to be generally used. Wide wheels give an easier draught upon spongy and loose roads in general, although in roads

already cut up by narrow wheels wider ones might even increase the draught by being obliged to widen the rut where the surface would not carry the weight of the load. It may be added that the advantages of wide tires to the highway are nearly, if not entirely, lost when the tire, instead of being flat, is rounded in form, in which case it is pressed into the pathway in the centre, and has the effect of a narrow wheel in breaking it up.

Conical wheels, made dishing, as we often see them, with the tire so set that the bearing on the ground is on the inside edge of the wheel, injure the path by cutting it up by reason of the unequal bearing, and they also have a compound dragging motion, caused by the tendency of the larger edge to go faster than the other. The wheel, notwithstanding this tendency, is forced straight forward, thus grinding and displacing the surface materials.

The use of upright wheels on straight axles with square tires should be encouraged.

On a broken stone road, firm and compact, the load ought not to exceed one ton to each wheel of ordinary size, having a tire four inches broad if without springs, or two and a half inches broad with springs. It may be added that wheels of small diameter are more destructive to roads than those of larger size. Roads of broken stone are much benefited by being rolled, when constructed or repaired, with an iron roller of two or three tons weight. In France steam rollers weighing ten tons have been recently introduced.

CONDITION AND RESOURCES OF GEORGIA.

BY REV. C. W. HOWARD, LIVINGSTON, GEORGIA.

The State of Georgia covers an area of fifty-eight thousand square miles. It is the largest of the old States east of the Mississippi river, except Virginia, extending through more than four degrees of latitude and five of longitude. It is equal in size to England and Wales, and larger than Holland, Belgium, Denmark, and Switzerland united.

The following statistics are condensed from the census of 1860 and the Comptroller General's report for 1866. The population of Georgia in 1860 was 591,588 whites, 3,500 free colored, and 462,198 slaves; total, 1,057,286, being 18.23 to the square mile. The ratio of increase of population from 1790 to 1860 was nearly 1181 per cent., the population of the State in 1790 being but 82,548, a much larger increase in the same period than that of any of the New England States, or even New York or Pennsylvania.

The number of polls of whites in 1860 was 99,748; in 1866, 86,909; decrease, 12,839. Number of negro polls in 1866, 55,909. The decrease is not stated, though it is known to be enormous from the deaths and emigration to the west.

The total value of property, including slaves, in 1860, was, in United States currency, \$1,008,484,165. Total value in 1866 was \$222,183,787; decrease and loss, \$786,300,378. The total value of property, exclusive of slaves, in 1860, \$554,441,883; in 1866, \$222,183,787; decrease since 1860, \$322,258,096. The taxable property of 1866 amounts to \$207,051,677, exclusive of railroads, banks, express companies, and foreign insurance agencies.

The total value of land in 1860 was \$161,764,955; in 1866, \$103,112,524. The average value per acre in 1860, \$4 85; in 1866, \$3 42, being a decrease of

$1 43 per acre. This decrease is greater now than when the report of the comptroller was submitted.

Of farms of more than 1,000 acres there were, in 1860, 902, being a much greater number of farms of this size than in any other State. The average number of acres to the farm in Georgia is 430. The number of farms is 62,000; acres of land improved, 8,062,758; of land unimproved, 18,587,732.

The products of the State in 1860 were: tobacco, 919,318 pounds; sugar, 1,167 hogsheads; hemp, 31 tons; peas and beans, 1,765,214 bushels; cotton, 701,840 bales of 400 pounds. Access has not been had to means of information as to the grain crops since 1850. At that time the products were: corn, 30,080,099; oats, 3,820,044; wheat, 1,088,534; rye, 53,750 bushels. In 1860 there must have been a vast increase of each of the above mentioned grain crops. The war has again reduced them. Added to the casualties of war there have been two consecutive years of drought, so that during the last year there has not been sufficient grain raised in Georgia to feed its population and live stock.

The value of city and town property in 1860 was $52,709,122; in 1866 it was $39,396,181. Money and solvent debts in 1860 were $161,004,887; in 1866, $34,521,678; a decrease of $126,482,709. Merchandise in 1860, $23,365,789; in 1866, $10,933,173; decrease $12,432,616. Shipping and tonnage in 1860, $1,415,910; in 1866, $215,667; decrease $1,200,243. Stocks and manufactures in 1860, $6,051,373; in 1866, $4,120,489; decrease, $1,930,884. Property not enumerated in 1860, $63,640,942; in 1866, $28,751,667. Estimated losses on railroads, $15,000,000; on banks, $30,000,000; on public buildings and churches, $10,000,000; total loss since 1860, $841,254,876. This loss occurs in a State in which there are but 99,748 white polls, being an average of $8,423 to the poll.

The entire debt of the State is $5,706,500; assets, in round numbers, $9,000,000. Its taxable property is more than $200,000,000. The State is therefore perfectly solvent. The new bonds are now selling at 97 cents, and must soon be at par. The State tax is but one-sixth of one per cent., being almost nominal.

Affected by the terrible casualties of war, by loss of loved ones, loss of property, by the almost entire loss of two consecutive crops, the people of Georgia have still not "despaired of the republic." Leaving public affairs to the management of those who have control of them, they have addressed themselves with sublime energy to the work of reconstructing their lost fortunes. If they fail, it will be from the operation of causes beyond their reach. Burned cities and villages have been rebuilt, every railroad has been repaired and is again in running order, new railroads are in progress of construction, factories have been rebuilt, and new ones on a larger scale will soon be completed, the old mines are worked, and every where in the mining region new shafts are being sunk. Failure from seasons and defective labor have but served to stimulate the farmer and planter to greater exertions. There has been no whining, no gloom, no prostration. The people see that they made a great mistake, and instead of merely deploring the past, they are determined to make the best of the future. It is an exhibition of elasticity under misfortune which can be presented only by the Anglo-Saxon race.

Climate, geological formation and products naturally divide the State into northeastern, northwestern, middle, southeastern, and southwestern Georgia. Each section differs materially from the others. In fact, it would be difficult to point out another country of equal extent in which so great a variety of soil, climate and products can be found as in the State of Georgia. In one extreme are produced oranges, lemons, bananas, olives and other tropical fruits; the other yields all the products of the northern States. One cause of this variety is the different elevation of the several sections. The town of Marietta, in Cobb county, about 300 miles distant by railroad from the coast, is twelve hundred

feet above the level of the ocean, the country descending from it north, west and south. There is scarcely a plant of value to man, except coffee, which cannot be grown successfully in Georgia. There is not a metal of material use in the arts, except tin and platinum, which is not found in workable quantity in this State. It therefore contains within itself all the essential elements of independence in a remarkable degree, is capable of producing all the requisite articles of food and clothing and most of the luxuries for a very large population, and possesses abundant water power to run all necessary machinery. With sufficient capital and population, and with a proper division of labor, nothing need be brought from abroad but coffee, while the cotton, rice, lumber and mineral products would give it a large export trade.

Northeastern Georgia is primitive in its formation, limestone being found only in a few scattered localities. This section is strictly mountainous, some of the mountain peaks being of great elevation. The summer climate is delightful in temperature, and perfectly healthy. The scenery well repays the attention of the tourist, as in no part of the United States is it finer. The creek and river lands are rich, producing fine crops of grass and grain, while the uplands are generally rolling and comparatively thin. The markets for this section are Athens and Atlanta. No railroads pass through it, though several are in contemplation and will be built. The farms are generally small, and the lands cheap. Northeastern Georgia has felt the effects of the war less than any other portion of the State.

Northwestern Georgia, touching both Tennessee and Alabama, is one of the most admirable portions of the United States. It is a blue limestone region, bounded by the Chattahoochee river on the south, the primitive mountains on the east, and Lookout mountain on the west, touching the Tennessee river on the north. It is the connecting link between the Great West and the Atlantic. The Etowah, Coosawattee, Connasauga, Chickamauga, Oostanaula, Chattanooga, and Coosa pass through it. The Coosa is navigable from Rome to the falls above Wetumpka, in Alabama. The attention of capitalists is being turned to these obstructions, and when they are removed, which must ere long be the case, navigation will be uninterrupted from Rome to Selma and Mobile. The Oostanaula is navigable from Rome to Calhoun for small steamboats. The head waters of this river can be connected by a canal with the Tennessee river, and a glance at the map will show the national importance of this grand work of internal improvement. The want of this canal and these obstructions on the Coosa are all that now prevent water communication between East Tennessee and Mobile, and the three States are deeply interested in opening this communication with the least possible delay.

The great railroad trunk, the Western and Atlantic road, built by the State, passes through the heart of this section from Chattanooga to Atlanta. Besides this the Dalton and Selma railroad will soon be completed. A short railroad connects Rome with the Western and Atlantic road at Kingston. The products of northwestern Georgia can be transported by direct lines of railroad to Charleston, Savannah, and Mobile towards the south, and Nashville and Knoxville towards the north.

Before the war there were several flourishing towns, but Cassville, formerly having a population of two to three thousand, was burned during the war, not a house being left standing. Marietta was greatly injured. Rome escaped with comparatively little loss, and has regained its former prosperity. This place, (Rome,) situated at the confluence of the Etowah and Oostanaula rivers, and remarkable for the beauty of its situation, must, from its connections and the great fertility of the surrounding country, become a town of considerable importance.

The river and valley lands of northwestern Georgia are very fertile, and comparatively fresh, as the Indians were removed in 1839. The valleys vary in

width from one-fourth of a mile to two miles. In 1860 these river and valley lands readily commanded from ten to seventy-five dollars per acre; now they can be bought much cheaper, as this section suffered more from the war than any other portion of Georgia. Wheat yields from seven to thirty bushels per acre, and is usually sowed on stock land, without ploughing. The ground is not manured, except in rare instances, and then on small lots. A large amount of wheat was annually shipped from this section to New York, where it commanded the highest prices, not only from its excellence, but from its being so much in advance of the northern crops. Corn ranges from twenty to fifty bushels per acre, the land being broken up with a one-horse plough, and not manured. With manure and deep ploughing as much corn per acre can be made in this section as from any similar lands in the United States. Clover and the grapes grow well. On the Etowah river, and in those valleys in which the soil contains sand, cotton yields as much per acre as in any part of the State.

The climate is agreeable, being bracing in winter and cool in summer, though not so cool as in the mountainous portion of northeastern Georgia. It is perfectly healthy, except in the vicinity of sluggish creeks, where there is a liability to chills and fever. The water power is abundant, and is frequently found on the line of the railroads. Bituminous coal of excellent quality is extracted near the Tennessee line, and iron ore, lime, cement, slate, and white marble abound. But of these more will be said hereafter.

The writer is familiar with the middle and northern States, and has travelled extensively in Europe, and does not hesitate to say that he has not seen a section of country in which Providence has heaped together so large a number of things desirable for the comfort and prosperity of man as in northwestern Georgia. Reference is made to natural advantages, as soil, climate, variety of products, and access to markets, with the qualifications of discomfort which must necessarily exist in a new country. Middle Georgia extends north and south from the Chattahoochee river to the flat pine woods which reach from the coast about one hundred miles inland. There are no mountain ranges, the surface being gently and pleasantly undulating. Large portions of this section were originally very rich, being covered with wild pea vines and nutritious grapes; but they have been scourged by bad cultivation, and are worn and gullied to a deplorable degree. The average product, without manure, is now about 500 pounds of seed cotton, seven to ten bushels of corn, and five to seven bushels of wheat per acre. Manure acts well upon them, and it is easier to restore an acre of these lands to their original fertility than to clear an acre of new ground.

Before the war lands in middle Georgia averaged, perhaps, ten dollars per acre, but they would not now command half of that price. A large amount of these lands will be left this year uncultivated, from the impossibility of obtaining reliable labor. Most of middle Georgia is quite healthy, the winter being mild and the summer warm, though not so hot as to interfere with white labor, which can be used to advantage. The climate is incomparably better, winter and summer, than that of the new northwestern States, towards which the stream of emigration is so largely turned.

The principal rivers are the Savannah and its tributaries, the Oconee, Ockmulgee, Flint, and Chattahoochee. The Savannah is navigable to Augusta. The rivers are bordered with bottom lands of great fertility, covered with the most valuable kinds of timber; but these are generally liable to overflow, and have not been reclaimed, though protection against overflow is perfectly practicable. These bottom lands are sometimes four or five miles wide, with a soil of great depth, and there are probably more acres of rich unreclaimed swamp lands in middle and southern Georgia than the whole of the kingdom of Holland. They require capital and labor, but when reclaimed will bring more than a bale of cotton to the acre, or may be converted into beautiful meadows of herdsgrass or timothy. This description of land would probably not now command more

than one dollar per acre. The rivers are navigable during the winter by small steamers, and during all the summer timber can be floated to the coast. In consequence of the increasing scarcity of mahogany, European attention has already been turned to these lands as a source of supply of white oak, ash, gum, walnut, &c., to be used for furniture, and one Belgian company has now an agent procuring these kinds of wood. The timber on this vast extent of bottom land would more than pay the purchase, drainage, embankment, and clearing, and leave the purchaser a princely farm without cost.

The principal towns of middle Georgia are Augusta, Atlanta, Macon, Columbus, and Athens. All of the towns of Georgia have, to a great degree, recovered from the effects of the war, and business is active, and rents high. City property suffered comparatively little, except in Atlanta, which was almost entirely destroyed. The rapidity with which this city has been rebuilt is almost magical; two years ago it was literally a heap of ruins, now scarcely the scars of the war are left. Both its business and population (now 20,000) are greater than before.

There are four male colleges and a large number of female collegiate institutions in middle Georgia, and most of them have able faculties and are in a prosperous condition.

This part of Georgia is a network of railroads, of which there are upwards of 1,400 miles in the State, Atlanta being the great centre. There are now four lines of railroads from Atlanta, and two others in process of construction; three from Augusta, Macon, and Columbus, and two from Savannah. The road from Macon to Brunswick, soon to be completed, must be the great thoroughfare by which the trade of Chicago will find its way to the South American markets.

Southeastern Georgia comprises the flat pine region, and the rice and sea islands on the coast. The pine land is very poor, and is valuable only for range and timber. The rice and sea island lands were, before the war, extremely valuable, but have since depreciated greatly, as they can be worked only by negroes. These lands, especially the rice lands, are too sickly to be the permanent home of the white man, and the planters formerly spent their summers in travelling, or on occasional healthy spots in the pine woods, within reach of their plantations. They can be converted into meadows of the finest quality, and will yield heavy crops of clover, timothy, lucerne, and herdsgrass. The West India market is near, and the product of an acre of good hay will sell for more money, after deducting expenses, than that of an acre of rice. The grasses require no labor after sowing until after hay harvest, and the whole crop can be saved before the sickly season commences. This work could be done by white men. These lands are as rich as the delta of the Nile.

Savannah is the chief seaport of the State. Business in that city is very active, and property has advanced in price. The voting population is considerably larger than before the war. Brunswick, perhaps, now offers the most promising results to enterprise of any southern town. Its harbor is one of the finest on the Atlantic coast, and the railroad from Macon, the early completion of which is now secure, must give it much importance. The lumber trade alone would make it a city of considerable size.

Southwestern Georgia is in the tertiary formation, resting on what is called the bottom limestone. This is the great cotton region of the State, and, perhaps, the best in the whole south. The product per acre is not equal to that of the bottom lands of the southwest; but the crop is so certain, the climate so suited to the cotton plants, the soil so easily cultivated, the liability to diseases of the plant is so small, and its products can so readily be sent to market, that it may be safely said to be the best cotton region of the whole south. Some of the planting interests are very large; one gentleman during the war is said to have cultivated twelve thousand acres in corn, cotton being prohibited.

Southwestern Georgia is comparatively a new country and was but recently the home of the Creek Indian. The great value of the land secured at once a

dense population, and towns and railroads were built and an immense extent of land opened for cultivation. Besides being fresh, the land is quite level and is easily worked, the usual allowance for cultivation being sixty acres in cotton and corn to the hand. So entirely has this region been devoted to cotton, that but little attention has been given to grain; corn, however, makes a good return, and the occasional experiments with wheat have been satisfactory as to quantity and quality. It is certain that the further south we go where wheat will grow, the heavier is the grain, and sixty-four pounds to the bushel is not an unusual weight for wheat in lower Georgia. It is cut early in May. Sugar cane (not sorghum,) grows well, each planter usually making his own sirup and sugar. A really thrifty farmer in southwestern Georgia need buy very little to eat or wear, as he can raise his own meat, corn, wheat, cotton, wool, sugar, sweet potatoes, rice, and tea, besides every variety of vegetables grown at the north.

Prior to 1861 good plantations commanded $20 to $30 per acre, but it is doubtful whether the average would now be higher than $5 per acre.

Some portions of southwestern Georgia are healthful, while others are quite malarious, and white men especially are liable to disease. The water is generally bad, and in the sickly portions white labor of *unacclimated* persons during the summer would not be safe.

The rivers are the Flint, navigable to Albany, and the Chattahoochee, navigable to Columbus. Three railroads pass through this region connecting it with the Gulf, the ocean, and middle Georgia. Columbus is a growing city of 10,000 inhabitants, with an immense water power, but partially in use. It is estimated that the water power at Columbus is much greater than that at Lowell. Albany, Americus, and Cuthbert are thriving towns.

After this general survey of the State the following particulars will be of interest:

AGRICULTURE.

The agriculture of Georgia has been in some respects as bad as it could be. There has been no deficiency in intelligence, but it has been wrongly directed; nor of energy, for the Georgia cotton planter, as a general rule, was among the most energetic of men; nor of income, so far as immediate returns were concerned; but there was a great deficiency as to comfort and the permanent prosperity both of the planter and the State. Land was hardly regarded as capital to be increased, but rather as part of current expenses, and the negro was the capital. But the land was something to be used until it was worn out, then sold for a trifle and abandoned, and the former owner moved to new lands in the west, there to repeat the same process. The course of cultivation has been generally cotton and corn until the land refused to bring remunerative returns of either, when it was *rested* with small grain. In a rolling country of which sand forms a large constituent and therefore very liable to wash, the life of the soil was very brief, and a few years of this cultivation rendered it useless, and it was then turned out to be grown up with briars, broom sedge, and old field pines. Two-horse ploughs were rarely used, and manure was seldom applied to any crop, except cotton seed on corn and wheat. Hancock county and some of the adjacent counties should be an exception to the above general remarks. There a course of improvement had commenced, in the advance of which was Mr. David Dickson, of Sparta, who planted nine hundred acres in cotton and eight hundred in corn, besides small grains, the whole of the 1,700 acres being manured, the corn with cotton seed and the cotton with guano, at an annual cost of $10,000. This gentleman made money in the right way, his crops were heavy, and his land was improved both in condition and salable value. Throughout the State there were similar isolated examples. The remarks made on the system of agriculture in Georgia are of general and not universal application.

Under the influence of this system the planters became as migratory as the nomadic tribes, and this disposition was the curse of the State. It was a preventive of permanent and comfortable improvements, and an enemy to the sweet ennobling sentiments which cluster around an old homestead. It was a barrier to the preservation and amelioration of the soil; hence landholders in the undulating portions of Georgia are left with an impoverished and gullied soil as their only capital. Emigration is no longer possible, for they have neither money with which to buy western lands nor negroes to work them, and they must now improve the lands which they own, or be wholly ruined. We may thank God that our generous mother earth, oblivious of the wrongs done her by her children, will richly repay every filial effort. The losses of the planters have been terrible, but with a climate so genial, a soil so improvable and yielding products so valuable, it will be their fault if under a new organization of labor and a new system of agriculture they do not attain more than their former prosperity.

THE FREEDMEN.

In many respects the conduct of this race of people, since the war commenced to the present time, has been most remarkable. Their behavior during the war was admirable. The wives and children of the confederate soldiers were at their mercy; they knew perfectly well that their freedom would be the result of the success of the federal arms; no white men were left at home out of the cities but infirm men and exempts, neither of whom were to be feared, yet never were the plantations more faithfully worked, never were the negroes more industrious or more deferential to their mistresses and the children of their masters. The South owes them a debt of gratitude, and all reflecting and good men acknowledge it, and will pay it if left free to act.

After the abolition of slavery it was feared that the negroes, intoxicated with their new found liberty, would rush into excess and riot. The fear was unfounded, and with few exceptions they have been quiet and respectful, but their freedom has developed the inherent defects of the race, indolence and want of thought for the morrow. Hence in many parts of the State they are unwilling to make contracts for farming labor, to be paid at the end of the year in kind or in money, their food being provided. They are more willing to work when they can be paid by the week or month, as they thus obtain ready money. This difficulty in making contracts occurs to the greatest extent on the sea coast. In one instance, on a rice plantation on which 1,000 acres of rice were planted last year, fifty acres were cultivated, and when the rice was ready for harvest every negro left the place, the rice was not harvested, and both the planter and the negroes lost the entire crop. For that very large interest the owner this year has been able to contract for but twenty hands. In many other instances they are unwilling to contract to labor for more than two days in the week. In very many cases planters have failed to obtain any hands at all, and thus large plantations are left wholly uncultivated.

This kind of labor, defective as it is, is rapidly diminishing in Georgia; comparatively few negro infants will be hereafter raised. Infanticide was often prevented on large plantations with extreme difficulty by the most vigilant care of the mistress. Now, relieved from the control, and unwilling to be burdened with the expense and care of children, when they can hardly support themselves, this crime has become more frequent. Thousands, both of children and adults, have died from disease and exposure, it being their delight to collect about the towns and cities, where they contract vices and diseases; besides, every railroad train during this winter has been loaded with negroes going to the west under promise of increased wages, and the unfortunate people have in many cases been made the subject of infamous speculation. It is estimated that twenty-five thousand negroes have left South Carolina this winter for Florida and the west,

and the number which have left Georgia is much greater, as for some time the average number passing through Atlanta has been 1,000 daily. This depletion of labor still actively continues, and it is a matter of increasing importance to the planters. They offer ten to twelve dollars per month, besides food, house, fire-wood, and land for a garden, but the negroes are promised more in the west, and accordingly emigrate. There must be a cessation of this emigration and an increased disposition on the part of the negroes to labor for reasonable prices, or the introduction of new and reliable labor must follow. If neither of these alternatives occur, a very large proportion of the best cotton and rice lands in the older cotton States must be wholly unproductive.

COTTON.

The cotton crop of Georgia in 1860 was 701,840 bales; that of 1866 is estimated at 200,000 bales, a decrease of 501,840 bales. A considerable portion of this decrease is owing to an unpropitious season, but much more to the diminished quantity of land planted and the defective labor employed in its cultivation. Large cotton plantations will cease to exist in Georgia, except in rare instances. During the last year, in a few cases, large planters have made a little money over expenses. In most cases, however, there has been a positive and heavy loss. As an illustration, one of our most skillful planters borrowed $40,000 to enable him to conduct his two plantations—one of rice, the other of cotton. His whole crop sold for $20,000, a loss of $20,000 on the year's work.

The experiment of conducting large rice and cotton plantations with the present system of labor has proved a failure, and few planters will again venture the experiment.

A plantation working 100 hands and 60 or 70 mules requires a very large outlay in advance, and such is the insecurity of labor, so little do the negroes observe the obligations of contracts, that after all his outlay in the way of mules, tools, provisions, &c., the planter may be left in the midst of the crop without a hand to work it. Under the most favorable circumstances the cotton crop of Georgia the coming year must be very small. The decrease of hands (between 12 and 65 years of age) employed since 1863 has been 139,988. Is cotton, then, to cease to be a staple crop of Georgia? Certainly not. It must, however, be greatly diminished for a term of years until the system of cultivation is improved and a more reliable form of labor introduced.

Having experienced its value, the human race cannot dispense with the cotton plant. The writer quotes from an address delivered by himself some years since: "In the variety of its uses, in its employment of multiform labor, in its general economical relations to the State, in its capacity for the support of a dense population, this plant is certainly, of its kind, the most bountiful boon of a kind Providence.

"It furnishes the sails of commerce and provides freight for the ships which they impel; it gives raiment to the laborer, the lines with which he guides his plough, the bed on which he sleeps, a light to his dwelling in the darkness; it affords at once the raw material for almost fabulous machinery, and a lubricating oil for its hinges and joints; it is a fertilizer to the soil, and to the animals which supply the table the most fattening food yet known to man. We have not yet ascertained, we probably have not approximated, the number of pounds of cotton which can be produced upon an acre of perfectly cultivated land. Nor have we ascertained, by consequence, how large a population to the square mile can be sustained in a country in which the culture of this plant is conducted with the highest degree of agricultural skill. Quite certain it is that no other product of the soil will give employment and support directly and indirectly to a population so dense as this 'king' of the vegetable world."

In despite of the gloomy present, cotton must be made, but for a term of years

at least, on small farms and with a mixed husbandry. One idea is as hurtful to the soil as the brain.

It is true that cotton is the least exhausting of all ploughed or hoed crops. How can it be otherwise when every thing is returned to the soil except the mere lint and cotton? The leaves and stalks are of course returned. The source of nutriment of the plants is largely atmospheric. The seeds are an excellent manure for wheat, and corn after cotton thrives remarkably, almost as if it were directly manured. There is not a cotton-seed oil mill in Georgia, but the seed in its crude state is heaped up for manure, while a portion of it is sent to England and to the north to be manufactured into an oil equal to olive for the table, and admirable for lubrication in its clarified state, and the manure of animals fed from the oil cake is superior, according to English experiments, to that of animals fed even upon our Indian corn, which ranks next in value. In a rolling country with a decided element of sand in its composition, land cultivated in cotton and corn for a succession of years will wash and become exhausted and gullied. But this is the fault of the farmer, and not of the plant; any hoed or ploughed crops, steadily repeated, would produce the same results.

Two-thirds of the strictly cotton lands of Georgia can be cultivated by white labor. In some sections it might be necessary to be careful about working in the mid-day's summer sun. But what is this loss compared with the loss of a winter, when the soil is covered with snow or locked up with ice? Nothing in Georgia interferes with agricultural labor in winter but rain, of which it has no unusual share as compared with other portions of the United States.

The rainy days of winter are scarcely sufficient to get every thing ready in the way of fencing, mending, &c., for spring. By manure and deep ploughing, an acre of these uplands in Hancock county, worth, according to average value, five dollars in 1860, has been made to produce 3,000 pounds of seed cotton, or 1,000 pounds of clean cotton, at present prices worth three hundred dollars. Any tolerable hand can cultivate ten acres, equal, according to the above product, to three thousand dollars. This is an extreme result, both of prices and products, but is now within reach of the skillful and industrious laborer.

In the older and healthier portions of the cotton region of Georgia a farm of one to two hundred acres can be bought now at from one to five dollars per acre, including comfortable improvements—a price, perhaps, not one-tenth of the original cost of fences and buildings. Suppose a laboring man with money enough to buy such a farm, and also with money enough to buy guano or superphosphate of lime sufficient to manure ten acres for cotton, say a capital of twelve to fifteen hundred dollars. This ten acres he can easily cultivate, besides raising his own meat, corn, wheat, &c.; when the cotton is matured, his wife and children can pick it for him. He is at no expense but his own labor, and that of his own family. By degrees, as his means increase and as he can procure reliable labor, his operations are increased, with nearly equal profits. Is there any other mode of farming in which he can earn so much?

During the past year there have been numerous experiments of northern men in different parts of the south in cotton growing, and about as many failures. They forgot the old Latin adage, "The cobbler should stick to his last." They were for the most part sutlers, quartermasters, or federal army men, of one kind and another, who knew nothing of the negro, and yet hired him—who knew nothing of southern soil, climate, and products, and yet sought no advice from those who did. Of course they failed.

We must have white labor, and there are three ways by which its attainment is possible. First, to try foreign immigration. The expenses of the immigrants, for the present at least, must be prepaid. Where is the money to come from? The planters cannot advance sufficient money to secure household wants from abroad.

Northern companies may buy up large bodies of land, divide them into small

lots, and either sell or rent to tenants—an investment, at present prices of land, of the most profitable nature, but requiring heavy capital.

Georgia land owners may divide their own tracts, and put up cabins and lease for a term of years, say from ten to twenty, with a stipulation as to rotation of crops and manure, according to the English practice. If a planter is willing to sell his land for ten dollars per acre, he can afford to lease at one dollar per acre annual rent, which would be ten per cent. on the price of his land. The latter would be the best arrangement for him, if practicable. The second, as soon as public affairs are settled, will probably be the most feasible. But in either event we must go back (possibly forward) from large farms to small; our present labor demands this. Afterwards, under a new system of labor, there may be a return to large plantations, with increased results.

GRAIN.

The product of corn in Georgia is in proportion to the labor bestowed upon it. The highest known yield of corn was that produced by Dr. Parker, of Columbia, South Carolina, who made two hundred and twelve bushels and some quarts from an acre of land. The ground from which this immense return was received was scarcely an average sample of the soils in South Carolina and Georgia. It shows what is possible in our climate under high culture. The danger to the crops is from drought, the effects of which can be measurably obviated by deep ploughing, early planting, and early varieties of seed. Fair crops even last year were made by those persons who planted early and used northern seed corn. The present product ranges from seven to fifty or sixty bushels per acre, according to soil, seasons, and culture. With the cultivation and manuring common to good farmers at the north, an average of fifty bushels of corn to the acre can be produced one year with another. Heretofore the land has been rarely manured. The ground is broken generally with a one-horse coulter plough (both plough and stock generally made on the farm) to an average depth of three to four inches. Is it a wonder that lands so treated should suffer from drought, and produce small crops? The pea crop planted in between the rows of corn, it is estimated, will, of a fair year, cover the expense of cultivation of both crops.

Wheat is usually sowed on stalk land after the corn is gathered, and without previous ploughing. Almost the only manure applied to this crop is cotton seed, and this is done in comparatively rare instances, but always with beneficial effects. The only instance in the State, in the knowledge of the writer, in which wheat was sowed on an inverted clover sod, was in Barton county. The yield was forty bushels to the acre. In another instance, in Hancock county, in middle Georgia, wheat sowed on a well turned Bermuda grass sod produced thirty bushels to the acre. The chief casualties to which wheat is subject are smut and rust. The former can be effectually prevented by soaking the seed in a solution of bluestone; the latter, to a good degree, by sowing early varieties of bearded wheat, as it is only late wheat which is affected by rust. Good bottom land in middle and upper Georgia has frequently produced twenty to thirty bushels to the acre. But at present, from imperfect culture, the absence of manure, and the prominence given to cotton, the average yield is very small, not more than six or seven bushels per acre. The earliness at which the wheat crops mature in Georgia always secures the best prices. New flour can be shipped from this State some time before the northern wheat harvest begins.

THE GRASSES.

On all lands in Georgia, with a good dry subsoil, clover will grow well, if the soil be naturally or artificially rich enough. In northwestern Georgia, on fresh land, clover does admirably. In middle and lower Georgia a heavy manuring

is generally necessary, the cost of which may be repaid by its application to wheat with which the clover is sowed. It must be lightly grazed during the heat of summer, but grazing may be commenced in April, interrupted in July and August, and resumed in September, continuing until January. The stubble fields will carry the stock well during the interruption. Herdsgrass and timothy thrive well on rich bottom lands of a close texture throughout the State. The most valuable of all forage plants is lucerne. This grows as well in Georgia as in France, and in the quantity and quality of the hay produced is unrivalled. On lands made very rich it may be cut five times during the summer, yielding a ton at each cutting, commencing in April. The price of hay in Georgia is never less than twenty dollars per ton; now it is more than twice that amount.

On manured uplands blue grass, meadow oat grass, orchard grass, vernal grass, grow during the winter. If these are kept shut up from June until December, and stock is then turned upon them, horses, mules, cattle, and sheep will need no other food, and will keep fat. They thus do their own mowing and hay raising. What a diminution of expense in stock raising. What a saving in costly barns. What a singular advantage of climate. The writer exhibited at the State fair five three-year old Ayrshire heifers from parents brought from Scotland by himself, which never had been fed beyond what they had obtained by grazing, and never had been under a shelter. They were well grown, perfectly fat, and quite equal to heifers of the same age in Scotland.

If it will pay to manure a meadow on which the expense of cutting and curing hay is to be incurred, and also of barn to store it in, much more will it pay to manure land for winter pasture, on which an equal amount of stock is kept, without after expense. When land is made rich and sowed down to winter grass it is quite possible to raise good cattle, colts, and sheep, without any other expense than interest on land, salt, and occasional attention. If these winter pastures are laid down in thinned woodland, the additional advantage is derived of doing away with dead capital in woodland, besides feeding a number of hogs, as the acorn and chestnut rarely fail in thinned and pastured woodlands. Bermuda grass will be spoken of in connection with sheep-raising.

FRUIT.

The peach tree in Georgia is long lived and subject to very few diseases, and the fruit is largely used in fattening hogs. Shipping early peaches to the northern markets must become an important business near the lines of railroads on the coast.

It is to be regretted that the experiments in vineyards have not been more successful. These experiments were extensive, spirited, and expensive, but they have generally been abandoned. The Catawba has been almost exclusively used, and possibly some other grape may be found better suited to the soil and climate.

It was at one time supposed that good winter apples and pears could not be grown in Georgia, but since attention has been paid to native seedlings, fine and good keeping varieties of the fruits have been raised. The writer has seen together upon the table pears and apples of different years' growth. It is a surprising result that the best region for producing good winter apples is the poor and sandy belt just above the fall of the rivers in middle Georgia, a section so poor that, in the vernacular, it "will not sprout peas."

Really good cherries of northern origin and gooseberries do not thrive in Georgia, except in the mountain region.

The fruit business in melons, apples, pears, peaches, and market vegetables in Georgia offers an inviting field for enterprise. Atlanta being the railroad centre, and therefore most distant in point of time from New York by the two diverging lines, is fifty-six hours distant from that city. The freight on a bag of cotton from Atlanta to New York is seven dollars per bale, a fraction over one cent per

pound. Both freight and time are small, but the difference in season and price, according to season, is great. Let the market gardeners, who understand the importance of extra early fruits and vegetables, consider well the suggestion.

LIVE STOCK.

In 1860 there were in Georgia 130,771 horses, and 101,069 asses and mules. The number was greatly diminished by the war. If there was any money in Georgia to pay for them they would rule high. Prices, except in the cities, are almost nominal. Great attention was formerly bestowed upon blooded horses for the saddle and turf. Of late years the Morgan horse has been introduced, and found great favor as a horse "of all work." It must be many years before the stock of fine horses is replaced. Mules for the plough are in chief demand, and are mostly brought from the west, although with a proper attention to winter grass pastures a mule can be raised at less expense in Georgia than in Kentucky. In southern and southwestern Georgia all that is necessary is to enclose a canebrake, the young mule desiring no better food during the winter, and the range feeding him in summer.

In 1860 there were in Georgia 299,688 milch cows, 74,487 oxen, and 631,707 other cattle—in all 1,005,882. This was a large proportion to the 99,000 white polls in the State, being somewhat more than ten to the poll. The Durham, Devon, Ayrshire, and Bremen cattle have all been introduced. The pure Durham are too large for our climate and pastures; the others thrive as well as elsewhere under similar treatment.

In lower Georgia, in what is called the wire-grass region, cattle are raised largely, herds ranging from 100 to 5,000. These are neither fed nor even salted, no care being bestowed except marking and occasional penning.

With all the facilities for cattle raising in Georgia there is not a dairy farm in the State, except some small milch dairies near the cities. All the butter and cheese bought is from the north. There was one cheese dairy in the full tide of successful experiment, which was terminated by the death of the adventurous experimenter; yet the manufacture of a pound of butter or cheese does not cost more than one-half as much in Georgia as in Ohio or New York. In 1860 the butter crop of New York sold for twice as much as the cotton crop of Georgia, although that year the latter was more than 700,000 bales.

There were in Georgia, in 1860, 2,036,116 hogs, within a small fraction of as many as there were in Kentucky, and about four times as many as there were sheep in the State, yet the one requires grain, and the other does not. The one requires labor, and the other lives in the range. There were 33,512,867 hogs in the United States; about one-fifteenth of the whole number were raised in Georgia. According to the present system, which does not include grazing upon clover and grass, the hog is the most costly and least profitable stock raised in the State.

The census returns for 1860 show 512,618 sheep in Georgia. Of this number 25,432 were killed by dogs in 1866, yet the number of sheep is but little diminished since 1860.

Really good sheep, properly cared for and protected, are the most profitable stock which can be raised in Georgia. Under the ordinary system they are the least profitable, except in those portions of the State in which wool growing is a business. Ordinarily the farmer has not enough of poor sheep (yielding one to two pounds of wool) to deserve his attention, yet quite enough to make him lose his temper when the dogs kill them.. It would be cheaper to buy both wool and mutton than to raise them in this way.

The Merino, Cotswold, Southdown, and Tunis sheep have been fairly tried in Georgia and at very considerable expense. The best blooded sheep of the north have been reserved for trial. Intelligent breeders have united in the selection

of the Spanish, not French Merino. The Merino cannot thrive better elsewhere than in Georgia. The wool is rather improved both in quantity and quality.

The three different belts in Georgia require in each a different system of sheep raising. In northwestern Georgia the summer and fall range is ample. Wethers will live in the range all winter, but ewes and lambs require food for two or three months. The winter grasses, if sown, are amply sufficient for them, and rye pasture also answers well.

In middle Georgia Bermuda grass makes the best pasture. Probably no grass in the world gives an equal amount of grazing, winter and summer, as the Bermuda on good land, and if shut up during the summer it will keep sheep and cattle fat during the winter. It is the dread of the cotton planter, however, from the rapidity with which it spreads and the difficulty of extirpating it, and there are entire plantations in middle Georgia overrun with it. These have been abandoned by the cotton planters and can be bought as low as one dollar per acre in some cases. Many of these plantations have comfortable dwellings and out buildings upon them, are healthy and within easy reach of railroads. On land well manured or otherwise rich, Bermuda grass grows tall enough to mow and makes an abundant and nutritious hay.

Sheep raising is conducted on quite a large scale in southern Georgia, in the pine woods range. The flocks in some instances reach as high as 5,000 head. These sheep are never fed, summer or winter, living entirely in the range. They receive no attention except at marking and shearing times. The statistics of some of these grass counties show singular results in this connection. In 1866 Appling county had 8,210 sheep, 4,027 children between six and eighteen years of age, and 59 hands from 12 to 65 employed in all works. Coffee county had 12,390 sheep, 706 children, and 99 hands employed. Emanuel county had 15,249 sheep, 1,049 children, and 472 hands employed in all work. The number of acres of land in Emanuel county is 539,278, the average value of which is 98 cents per acre. The lowest average value of any county in the State is Telfair, containing 483,044 acres; average value 51 cents per acre.

In these counties, perfectly healthy situations can be selected. It is necessary to buy only a small number of acres for a settlement, the unfenced range being in common. Sheep can be bought at $1 50 per head. They are very inferior, but can be rapidly improved by a cross with the Merino.

It will be seen that Georgia affords great facilities for wool growing. In a large portion of the State sheep require no housing or feeding, and there are no "northers," as in Texas. The market for wool and mutton is within easy reach. Why, then, should the wool growers seek the west? With the subject of wool growing the writer is familiar from practice and observation at home and abroad. It is his conviction that considering the climate, price of land, markets and facilities for summer and winter grazing, middle and lower Georgia afford a prospect of more rapid fortune in wool growing than any other region within his knowledge. Cotton has heretofore blinded the eyes of planters to the value of their lands for this purpose. There is no reason why the wool crop of Georgia should not be larger than its cotton crop ever was. The drawback has been the number of dogs, of which there were 92,000 in the State. These, however, are diminishing with the diminution of the blacks, for every farm negro has his cur. The last legislature passed a law rendering it a penal offence for any one to enter with a dog in a field in which there are sheep, unless with the consent of the owner. There is reason to hope that this dog nuisance will soon be measurably abated.

METALS AND MINERALS.

It was the design of the writer to treat fully upon this branch of the subject, but the limits assigned him render this impossible, and it must be dismissed with a few general remarks. The white marble quarries of Cherokee county are of

great extent, a portion of them affording statuary marble. The slate quarries of Polk county are now attracting much attention. The slate is considered equal to the Welsh, and is now being shipped to New York. The quarry is of enormous extent. Hydraulic cement, nearly white in color and of excellent quality, is made near Kingston, Bartow county. The indications of petroleum in Floyd county are strong. That section has been thrown up in the wildest confusion. The formation is the lower Silurian, abounding in fossils, and both the limestone and shale are highly bituminous. Iron ore abounds in Bartow and other counties. Large investments of northern capital are now being made in digging gold and with fine results. If these mines were on the other side of the Rocky mountains; if there were hostile Indians between them and civilization; if it were necessary to transport provisions and tools on pack mules, there would probably be a great rush of adventurers to them. But they are in the "white settlements," 56 hours distant from New York, and are therefore not considered worthy of attention.

HOW NORTHERN MEN ARE TREATED.

This depends very much upon themselves; rude people will find rude people every where, as like begets like. There are two classes of northern men who cannot expect to be received with much courtesy. One is the class of correspondents of northern newspapers, who pass through the south misrepresenting the condition of things, thereby keeping open the wounds of our suffering country. The other is a class of men who provoke ill treatment by irritating and insulting remarks; but a northern man who comes here to live and minds his own business and identifies himself with the interests of the section which he has selected as his home, will be met and treated in his business relations with as much courtesy as any other good citizen. It is, however, proper to remark that families of refinement settling among us alone would hardly find their residence pleasant, however profitable it might be. They would not be disturbed, but they would be let alone. This is to be expected. We have passed through a terrible war. The superior numbers and resources of the North have overpowered us. It is human nature to be sore under such a result. It will be a work of time, the great healer, to remove this soreness. Our women, perhaps, feel this result more heavily than the men. While they would be guilty of no rudeness, for which they are generally too well bred, they would be averse, for the present at least, to intimate social relations with those who have been indirectly connected with the suffering which they have endured. These sufferings have in countless instances been terrible beyond expression. Every northern person of delicate sensibilities will readily understand and appreciate the condition of things referred to. It is due to them to express frankly the real state of facts to prevent a repetition of instances in which northern ladies have suffered keenly from a sense of isolation.

The money value of investments at the south now, in farming, machinery and mining, is indisputably great. To single men there is no drawback; for families these are the several disadvantages referred to. This can, however, be obviated by bringing their own accustomed associations with them, that is to say, moving in colonies. This was done in Dorchester, in South Carolina, and in Liberty county, in Georgia. The children of these emigrants are now among our most cherished and honored citizens. There might be several Lowells in Georgia. Colonists might purchase vast extents of cheap lands in a body. The water power, with cotton growing beside it, and the mining interests, offer the material basis of many large towns, the proprietors of which would grow rich by the simple advance in property. We are prostrate. There is now nothing of the spirit of "the dog in the manger" in our people. Georgia needs capital and worthy labor. It will be welcomed from whatever source it may come.

CALIFORNIA—HER AGRICULTURAL RESOURCES.

BY H. D. DUNN, SAN FRANCISCO, CALIFORNIA.

The agricultural resources of California are of such magnitude, of so varied a nature, and, when properly developed, will be so valuable, not only to the States and Territories lying contiguous on the Pacific slope, but to the United States as a nation, that it seems strange a more general knowledge of the same has not been heretofore attained by the American people. Settled originally, on the part of the Americans, by a few pioneers, whose frontier habits of life were of a wandering nature, the vast mines of agricultural wealth contained in the soil (other than those partially developed at the missions) were overlooked, and the country, aside from occasional river bottoms and a few small valleys on the coast, was deemed sterile and unsuitable for culture. Walled in between the Sierra Nevadas and the Coast range of mountains, the great interior valleys and plains, producing immense quantities of wild oats and indigenous grasses, were valued only for the purpose of cattle raising, large numbers of the latter being slaughtered for their hides and tallow, which were sold to the few trading vessels that yearly visited the coast. At the missions, the first of which had been located in 1769 and 1770, a few small tracts of arable land had been cultivated, the soil producing bounteously all the smaller cereals, while the grape, olive, fig, pomegranate, and other semi-tropical fruits, brought by the priests from Mexico and Spain, flourished as if in their native soil. Such was the condition of California when war broke out between the United States and Mexico in 1846, and such, in great measure, it continued to be until the necessities of a large mining population, in 1849, induced a more thorough and extensive search into the capabilities of her soil and climate. So ignorant were Californians of the agricultural resources of their State, as late as 1852, it was the general opinion of the people that, although immensely rich in minerals, it would always be impossible to support her then existing population without importing the greater part of the necessaries of life; that while there were a few valleys of undoubted productiveness, a vast proportion of the soil outside of the mineral regions was only suitable for the production of indigenous grasses for the support of cattle. With this mistaken view of her capabilities, many thousands of people left the country after having been successful in mining. Other thousands preferred to live without their families and the comforts of home while gold digging, under the idea that the mines, becoming soon worked out, with the staples of living imported, there would be no inducement to settle permanently in the State. These ideas were also propagated by returned adventurers in the Atlantic States, and greatly deterred the immigration of families, who were much needed to form a valuable and settled population in the agricultural districts.

SOIL AND CLIMATE.

The State of California extends along the North Pacific from 32° 20′ to 42° north latitude, and from 114° to 124° 33′ west longitude. Its greatest length is about 760 miles, in a northwest and southeast direction, averaging about 260 miles in width. A large portion of the country is mountainous or hilly, the great Sierra Nevada mountain range extending along its eastern

boundary, and the Coast range and kindred spur mountain ranges along the greater part of the western border on the shores of the Pacific. These two ranges of mountains connect by spurs in the north on the border of Oregon, in Siskiyou county, and again in the southern part of the State, near Santa Barbara county. Between these mountain ranges lie the great Sacramento and San Joaquin valleys, extending north and south for hundreds of miles, one valley being a virtual continuation of the other. These valleys are intersected by numerous streams, which flow from the mountains, and, combining, form the Feather, Yuba, Sacramento, American, Stanislaus, Tuolumne, Calaveras, Merced, San Joaquin, and other rivers. Some of these are navigable for light-draught steamers at all seasons for hundreds of miles above their mouths. The Sierras, along the foot-hills, contain many small valleys, which produce abundant crops of cereals, but are more especially adapted to the cultivation of the grape, olive, almond, and other kindred fruits. The Coast range is also penetrated by numerous fertile valleys, some of them, in the southern portion of the State, being quite large.

California has virtually but two seasons, viz: the summer, or dry season, and the winter, or wet season. The former generally commences in April, and continues until October, very little, if any, rain falling in the interval. The rain fall during the year varies somewhat in different localities; but throughout the State, in the few places where rain gauges were kept, the general average since 1850 has been from ten to forty-nine inches. With a fall of but ten inches, the result is a drought that destroys the larger portion of all crops, and, as was the case in 1864, insures the destruction of from one-third to one-half of the cattle and sheep that range in the lower valleys of the State. The forty-nine inches, in the interior, where the land is low and level in vast tracts, produce immense floods, as in the winter of 1861 and 1862. A fall of twenty-two inches of rain insures a very good harvest, while an excess of that quantity admits of the sowing of a greater breadth of land, which, with the fertilizing sediments deposited on the low lands, more than compensates for the damage done by floods to house, barn, and fences.

The climate of California varies greatly in different places. To describe it properly, it is necessary to divide the State into districts, either of which possesses a climate that differs materially from the others. For this purpose I make four districts, and name them, viz: North coast, south coast, interior valleys, and Sierra Nevada districts.

The north coast district includes the coast valleys and mountain ranges north of Point Conception, and is on an average forty miles wide. Its proximity to the Pacific ocean gives it a peculiar climate, the winters being free from excessive cold, snow rarely falling on elevations of 3,000 feet, or the temperature as low as thirty degrees Fahrenheit. Since 1850 there have been quite a number of winters when no snow has fallen, and there were only slight hoar frosts in December and January. The more hardy vegetables, such as the potato, cabbage, beet, turnip, cauliflower, parsnip, radish, &c., grow through the winter, and are gathered in every month of the year. Strawberries ripen in the open air in March, and the first cherries sometimes as early as the middle of April. Barley has been cut in the latter part of the same month, but more generally about the 15th of May. The greater part of the first hay crop is gathered early in April, and wheat is cut in some favored localities by the 15th of May. The weather during summer is comparatively cool, with occasional short heated terms, during which the thermometer ranges as high as from eighty to eighty-five, the nights, however, being pleasantly cool. The general temperature from April to November ranges from fifty-five to seventy degrees. From May to November this section of California is visited by strong northwest winds, which blow with great regularity from noon to sunset, when they die away, to be renewed the next day. These winds are often attended by dense fogs, which

prevail from 4 p. m. to 8 a. m. When these fogs first strike the coast they generally contain a great amount of moisture, and at times resemble a Scotch mist. This moisture is precipitated mostly on the hillsides and valleys next to the ocean, and keeps grass enough for feed until late into autumn, making this section peculiarly valuable for stock and sheep raising, and for dairy purposes. The dampness, however, injures the quality of wheat, barley, and oats exposed to its influence, and they become less dry and of a deeper red or brown color than the same varieties of grain raised in the eastern valleys of the district and other portions of the State.

The south coast district.—In this section the winters are still milder than further north, frost rarely occurring, while snow is seldom, if ever, seen, except on the tops of the highest mountains. The orange, lemon, lime, and citron are gathered from November to March, while green corn is to be had, where the ground is irrigated, from the first of May until Christmas. Generally, less rain falls in this district than in the others, but the total fall is distributed over a longer space of time, viz., from the first of October until May, a few showers falling, in some years, as late as July. In summer there are no strong northwest winds and no sea-fogs, such as prevail further north, while the temperature is also more equable, and ranges from sixty to seventy-five degrees, with occasional light dry fogs. There are sometimes periods of what may properly be termed "burning" weather, which do considerable damage to vegetation in very dry seasons. These, however, come at very long intervals, four and five years sometimes intervening, and generally after the main crops have been harvested.

Interior valleys district.—The winters of this district are somewhat colder and of longer continuance than those of either of the foregoing sections. The strongest frost, however, rarely produces ice of the thickness of an eighth of an inch, and vegetation is seldom more than two weeks behind that of the north coast district, oranges ripening in the open air as late as February. There is, however, a noted difference in the dry season, summer following close on the heels of winter, a very short spring intervening. The weather frequently attains its maximum heat about the middle of May, and continues sometimes, with slight intermissions, until October. This heat, however, is devoid of moisture, and resembles more the air from a hot oven than the same degree of heat found in any of the Atlantic States. Although the thermometer frequently ranges as high as 100 degrees, and in some portions of the valleys even to 113 and 115 degrees in the shade, the heat is borne by man and beast with less distress or danger than eighty-five degrees in the north coast district, or the same degree in the States east of the Mississippi river. In some portions of the Sacramento and San Joaquin valleys the heat is greatly mitigated by the northwest winds of the coast, which come through gaps in the Coast range mountains. These winds lose their moisture in crossing the mountains, and are tempered, as it were, by heat in passing over the valleys. There is, therefore, little or no abatement of heat experienced when they strike the foot-hills of the Sierra Nevadas, which gives that portion of the district a steady and equable temperature that is in the highest degree favorable for the best development of the vine, which cannot be found in such perfection elsewhere. This peculiarity of climate promises, in a few years, when vineyard proprietors acquire proper experience in wine making, to produce some of the finest qualities of wine known any where in the civilized world.

Sierra Nevada district.—This district comprises the hillsides and numerous valleys in that range of mountains above the altitude of 1,200 feet. The winters are quite mild, although snow falls to a very great depth in places above 3,000 feet elevation. These immense deposits of snow form the reservoirs of the numerous rivers that water the large valleys of the interior, and without which the former would become dry, or nearly so, during half of the summer. These snows gradually melt during the summer, but large quantities on the northern slopes

of the highest peaks continue from year to year, and are seldom entirely dissolved during the seasons of greatest drought. The great fall of snow in winter is unaccompanied by any severe degree of cold, it being quite difficult at times to obtain ice over an inch thick at elevations of about 5,000 feet above the sea. The way ice of sufficient thickness is had in these regions is by making ponds of water, in which a thin sheet of ice is formed; more water is then let on the surface of the ice and frozen, and the process is repeated until the thickness of the sheet is considered suitable to cut for consumption in the summer season. The Sierra Nevadas really comprise two parallel ranges of mountains, with numerous narrow valleys lying between. These valleys are very fertile, producing wheat and potatoes up to an altitude of about 6,000 feet. The crops, at that elevation, are sometimes cut off by late spring and early autumn frosts; but enough is generally produced of these staples to support, in part, quite a large population, while the grass lands are able to feed a much larger quantity of stock than will probably ever be needed for local consumption. During the summer the climate of this district is probably the most pleasant in California. The days are temperately warm, and the nights cool enough to make a moderate quantity of bed clothing desirable. For months at a time there is an almost cloudless sky. The vegetation in the higher portions of this district is always green, presenting a most pleasant sight to travellers who have journeyed across the parched valleys of the interior. The agricultural products of this section are relatively of higher value than in the others, because of the proximity of mining settlements, which afford a ready market, at only a small expense for transportation.

It is difficult to describe properly the soil of California, which is excellent for grain-growing everywhere, but varies greatly in appearance and composition in different portions of the State. All the valley lands which have been tried have proved well adapted to agricultural pursuits, and, so far as known, the bald hilltops, cultivated in very rainy seasons, have yielded fair crops of grain. In describing the climate of the different districts, I have given a description of the usual weather in ordinary seasons. Most of the sections described I have knowledge of from a personal experience of over seventeen years. That the winters of California are very mild, is self-proved by the semi-tropical fruits grown in the open air, such as the orange, lemon, and citron, which ripen in the northern portions of the State in January and February. The advantages of such a climate over the severe frosts and snows of winters in the Atlantic States and northern Europe are thus at once apparent, and need no argument to convince an unbiased mind. The freedom from rain for six consecutive months in summer admits of the cultivation of larger tracts of land in small grain, to each man employed, than in the Atlantic States, as the crops can and often do lie three months in the field, after cutting, before they are threshed and housed ready for sale.

POPULATION.

The entire population of the State is estimated, by the best judges, (in the absence of reliable census-returns,) at from 400,000 to 500,000 persons. Of these there are about 60,000 Chinese, who are engaged in mining and railroad building. The population of San Francisco is 130,000; that of other towns in the State, not engaged in farming pursuits, say 50,000; and whites engaged in mining, teaming, commerce, milling, and other kindred employments, 50,000 more—making a total of 290,000 persons who are consumers, and not producers. This leaves, at the highest estimate, about 210,000 persons unaccounted for, who form our agricultural population. Deduct from this number the women and children, and there are probably not 100,000 adults directly engaged in agricultural pursuits in California. With this comparatively small number of farmers we are fast taking a high rank in the list of wool, wheat, and barley-growing States,

while our production of wine this year exceeded that of all the other States of the Union combined. That the soil must be of an exceedingly fertile character, and the climate peculiarly favorable to agricultural pursuits, will be apparent when it is considered that this great interest has been virtually created since 1852. Up to that time not one tithe of the flour, barley, and some other staples consumed, were produced in the State; while for our fruit, sheep, hogs, and poultry we had to rely mainly upon importations from Oregon, the Hawaiian and other islands, and New Mexico. At the present time the home demand takes but a very small portion of some of the great staples produced, as California also supplies Nevada, Arizona, and portions of Utah and Montana Territories, besides exporting vast quantities of wheat, barley, oats, &c., by sea to different portions of the globe. When we consider that such great results have been attained through the labor of a comparatively small population, and that at the present time not one-tenth of the arable land in the State is under cultivation, the magnitude which the agricultural interests of California may assume, with a population sufficient to properly develop her resources, looms up with a grandeur greatly exceeding that of any other State in the Union. No other farming population in the Union have had to contend with the difficulties that have continually beset our people, and which have only within the last year or two been removed. Until within a comparatively short period a settler could scarcely find a tract of fertile land unoccupied that was not claimed under an old grant from the Mexican government. The boundaries of these grants being indefinite, and clouding the title to ten times the quantity of land called for, the settler had to risk what improvement he might put on the land to the mercy or caprice of the claimant of the grant. Under the ruling of our court claimants had the power to dispossess all parties, within the boundaries of which so small a portion of the land was granted, while awaiting survey. The grant having been nearly all definitely located and the public land surveyed, this condition, in respect to titles, has been changed, and parties wishing to settle on public lands, or to purchase of grant owners, can do so with a feeling of security not before known.

CEREALS.

In the production of some varieties of small grain California has no rival in the other States of the Union, and, all the circumstances attending cultivation duly considered, no superior in the world. In the earlier years of grain-growing the average product of wheat was between 60 and 70 bushels to the acre, in favorable seasons. Instances were common where large fields of from 60 to 100 acres averaged 90 to 100 bushels, and selected acres as high as 120 bushels. At the present time the average yield of wheat, *properly sowed* in ploughed land, is about 40 bushels per acre. A slovenly system of cultivation has, however, been introduced in the State, which has been in great favor with farmers. The majority of cultivators throughout the State have pursued the following plan, which not only gives a very small return for the land cropped, but also exhausts it of its fertility at a rapid rate: The new land is generally scratched or broken up by ploughing from three to five inches deep. Grain is sown, say wheat, which yields from 40 to 60 bushels to the acre, if the season is a fair one. The crop having been garnered, cattle, horses, sheep, or hogs are turned in on the stubble to fatten on the heads of grain that have been left or scattered by the reaper when cutting. When the feed gets poor the animals are removed, and the ground is harrowed with a light cultivator, but in the majority of instances by simply dragging brush over it. Our farmer now considers his field as sown, and awaits harvest time to reap the rewards of his labors. If the season is a fair one, the land produces probably 25 bushels of wheat. In many cases the process is renewed, and another but smaller crop harvested from the same ground, say from 12 to 15 bushels, in the third year. This process of cropping the land

is termed "volunteering," or "volunteer" crops. Under this system of culture the average yield of wheat throughout the State is reported by the county assessors at about 20 bushels to the acre. Their reports, however, are grossly inaccurate in some known particulars, and in the case of wheat-growing, ("volunteer" crops included,) from personal information derived from widely scattered sources, I am inclined to believe that the true average crop of wheat in California, in favorable seasons, may be estimated at from 25 to 28 bushels per acre. As a general rule, grain lands receive neither manure nor rest, the same ground being cropped with wheat for seven or more years continuously. A better system of cultivation is being inaugurated in some portions of the State by cropping one year and summer fallowing the next. By this plan, land that did not produce over 20 bushels of wheat per acre when cropped continuously, has yielded over 40 bushels of wheat, of a much improved quality. With a careful system of farming and the exercise of good judgment and energy, as is customary in the Atlantic States, the yield of wheat would average, on ordinary lands, nearer 50 than 40 bushels. With titles to land secure, and the experience of the evil of continuous cropping and "volunteer" on the soil, it is likely that the practice will be discontinued, or, at least, have its most objectionable features removed. When this is done, the great increase of production per acre will attract the attention of the civilized world to the wonderful fertility of the soil of California.

All kinds of wheat have been successfully grown in this State, but there are about five different kinds which have proved remarkably well adapted to the soil and climate, viz., white Australian, white and red Chile, Chile club-wheat, and Sonora. All these varieties have especially valuable qualities, making a stronger flour than is known to be produced from the different kinds grown in the Atlantic States. A peculiar feature in the wheat grown in the interior of the State is its dryness and hardness, which requires the use of water before the grain can be profitably ground. Millers in the Atlantic States, accustomed to grinding the soft, plump grain raised there, fail in making a good quality of flour from California wheat, from lack of proper knowledge in this particular. Without a desire to impugn the excellent qualities of the grain of the Atlantic States, our people claim that California wheat is superior to any grown elsewhere in the United States, making a first quality of flour that will bear transportation to any part of the world without damage from climate. Owing to large tracts of low lands in the interior being submerged by floods in very rainy seasons, the wheat crop of some portions of the State is being harvested while it is seeding time in others. This is particularly the case along the Lower Sacramento river, in Yolo county, where the years of high water always give them very heavy crops. Portions of other counties are also similarly affected on the San Joaquin and the Lower Sacramento rivers, the yield of wheat in such years being prodigious, considering the circumstances of its cultivation. Although the county assessors are required by law to make accurate returns of the principal agricultural productions of their districts, they have so far failed in giving statements that can be relied on as correct. In the absence of this information, the total yield of wheat, as well as of other grains in the State, has to be estimated from the receipts at the principal places of sale and shipment, and a margin allowed for the additional grain that still remains in the hands of farmers. Estimates made on this plan, by competent men engaged in exporting grain and milling, vary from 12,000,000 to 13,500,000 bushels of wheat as the crop of 1866. The difference between these estimates is as to the quantity of grain still in the hands of farmers throughout the State, and it is probable that the highest estimate is correct, as it is conceded that over 10,000,000 bushels will have been received in San Francisco alone before next harvest, mainly for exportation. This amount is said by parties of good judgment, who have travelled through the greater portion of the State, to be hardly a tithe of what could be produced in favorable years, if we had the requisite population and the most approved methods of farming. Two counties alone,

viz., Yolo and San Joaquin, have produced nearly 4,000,000 bushels of wheat in one season; and if all the land suitable for that grain had been cultivated, it would, under the same circumstances, have produced fully three times that quantity. California needs only an adequate population to vindicate her claim to be the greatest wheat growing State of the Union.

Barley.—Next in importance among the cereals is the production of barley, which is the favorite food for draught animals in the State outside of San Francisco. This grain is grown in every part of the State, and is an article of immense consumption. A comparatively small portion of the crop is exported, as it brings only about half the price of wheat, while the cost of transportation is the same. Besides feeding the draught animal of the farmer, barley is the only food used for the pack-trains which do the immense amount of transportation in the interior. The extent of this business can hardly be realized by persons who have not seen it; but they can form some idea when it is known that some of the routes traversed are from 500 to 1,000 miles long, and grain food for animals has to be carried almost the entire distance. With the exception of the Central Pacific, Sacramento Valley and Placerville, and Marysville and Oroville railroads, which form in the aggregate less than 200 miles of road, the people of the interior engaged in mining in California, Nevada, and portions of Utah and Montana Territories, receive almost all their supplies of food, raiment, furniture, and machinery through the use of teams. As steep grades have to be overcome, the draught-power of animals is reduced to an average of about 1,000 pounds per head in teams, and in pack-animals to about 200 pounds each, necessitating the use of a vast number of mules and horses, as oxen are too slow to suit the requirements of trade. A very large quantity of barley is produced in portions of the State where the cost of teaming prevents its being marketed, and it is therefore fed to hogs in the field, and after threshing. The average yield of barley, where sown on new land or land that has not been continuously cropped for a series of years, is about 55 to 60 bushels per acre in good seasons. Instances are very common, however, where the yield has averaged as high as from 80 to 100 bushels; and in 1854, a field of 100 acres, in Pajaro Valley, Santa Cruz county, averaged 133¾ bushels of clean, plump grain for the whole tract. The same remarks as to ploughing and volunteering apply to this grain as to wheat. The price of barley has ranged, during the last twelve months, at less than 90 cents per 100 pounds, delivered at prominent points in the State, the farmer having to bear the expense of sacks and transportation. It will be readily seen that, at such prices, there is very little inducement to grow the grain to a very large extent, except in places favorable to market, more especially as there is a comparatively light export demand. Barley is, however, so sure a crop, takes so little labor, is of such general use, and can be put into pork without expense of bags or transportation, that it will always be raised to a very considerable amount in California. As a feed grain it holds the same importance with our people that Indian corn does with the people of the so-called western States. All varieties of the grain, including "Chevalier" and Russian, or Nepaul barley, thrive well, the yield being, with only occasional exceptions, over 50 bushels per acre where the land is in the condition above stated. The total yield of barley for 1866 will approximate very closely to that of wheat. At the conclusion of this article I will give the receipts of this and all other grains for the harvest of 1866, to date, in San Francisco; and, with the exception of barley, would state that fully two-thirds of all grain crops are received in that city.

Oats.—The next cereal in importance in California is oats. This grain grows well in all portions of the State, but is of small consumption outside of San Francisco, whence considerable quantities are also exported to Australia and other points. The main portion of the crop is grown in the coast valleys, the soil and climate being peculiarly favorable for producing the grain. As a general rule, all varieties of oats yield well, but in some seasons the grain is quite light in

weight. The grain ranges from 32 to 43 pounds per bushel, the latter being the heaviest known. It generally brings one-half more in price than barley, but the crop in the State is probably not over a tenth in quantity as compared with that grain. In the interior of the State oats are not raised to any considerable extent owing to lack of demand, and the fact that other grain can be more profitably produced. The total crop for 1866 will be in the neighborhood of 1,200,000 bushels.

Corn.—This grain is raised in many portions of the State, but the total crop is a comparatively small one, owing to light demand and low prices. Along the rivers in the interior is a considerable extent of bottom lands which, so far as tried, have always produced generous crops of corn. Where these rivers receive their supplies of water from the snows of the "Sierras," the lands suitable for corn-raising are liable to overflow as late as April, and sometimes in May, when the early hot weather sets in. This has prevented many farmers from planting corn, as it has often happened that, with very late planting, the grain has not matured sufficiently before the next rainy season would set in, so that, when harvested, the yield was both light and of inferior quality. In the valleys in the coast district corn is so raised in many places, the yield being large, and the crop a certain one. The same favorable conditions are applicable in the southern portion of the State, in those places where the soil has sufficient moisture throughout the summer season. The most famous place for growing corn is, however, the Russian River valley, in Sonoma county, where very large crops are raised, only a portion of which is marketed in San Francisco. A very large part of the crop raised there, as elsewhere, is fed to hogs, which are afterwards mostly driven to that city and slaughtered. So far as known, corn averages all the way from 40 to 100 bushels of grain to the acre in favorable seasons. It generally brings a little higher price than barley, say $1 10 to $1 20 per 100 pounds; but there is no export demand, and the domestic consumption is of a very limited character. It is probable that the raising of this grain will never be very extensively engaged in, in the State, as barley can be raised everywhere cheaply, and is equally good for distilling and as a fattening grain for stock and hogs. The quality of the corn grown in favorable locations and seasons is generally superior, and compares well with that grown in the western States.

Rye.—This grain is of exceedingly small production, the demand being very light, and the price unsatisfactory to producers. It can be grown in most parts of the State; but in the interior, where extreme hot weather prevails at time of harvesting, it is apt to shell out badly and waste in cutting. The grain is generally of good size and quality, but there is scarcely any demand for it as an article of food. It brings about the price of corn, and the entire crop of 1866 was probably not over 20,000 bushels.

Buckwheat.—The crop of this grain is somewhat less than that of rye. The long, dry summers are unfavorable to its growth as a profitable crop, as compared with other varieties of grain. The quality of the buckwheat is, however, fully equal to the best grown in the Atlantic States. There is no export demand, and the home consumption is very light, the latter being still further reduced by millers grinding some wheat with it, the practice being more profitable than grinding pure grain. The total amount of the crop is variously estimated at from 12,000 to 13,000 bushels.

Millet, rape, and canary.—All these grains or seeds are produced in the valleys along the coast, both north and south. Millet is said to be of especially good quality—in fact, superior in size and looks to any imported. Rape and canary seed are both raised, and of excellent grain and appearance; the latter, however, is frequently sent to market imperfectly cleaned. The total crop of these seeds is quite limited, having been grown to supply the home demand, which is light. Enough, however, has been ascertained to guarantee that they can be raised in sufficient quantities to supply the entire Union, if required.

Flax seed and mustard.—These seeds are raised in considerable quantities in the coast valleys. There are as yet no mills for using the fibre of flax for bagging, and the first oil ever made in the State from flax seed was pressed in San Francisco in December, 1866. There is now a mill erected that will consume 150,000 bushels of seed yearly, which will be imported until the farmers of this State can supply the demand. The total crop of 1866 is generally estimated at less than one hundred tons of seed, but in view of the inducements for its cultivation it is possible that over twice that quantity will be harvested in 1867. The consumption of linseed oil on the Pacific coast is already of very large extent, and promises to increase. The mustard plant is indigenous to California, and more or less is found in almost all portions of the north and south coast districts. The native mustard is a small black grain of extraordinary pungency, and is highly valued for its medicinal properties. In the south coast district it is found in vast amounts, and considerable quantities have been exported to the Atlantic ports. All the other varieties of foreign mustard have been cultivated and produced superior seed.

Beans and peas.—Both of these products are raised to considerable extent, the crops turning out large and moderately profitable. Every known variety of bean has been tried, and all have given good yields when properly planted. The varieties of beans grown are so numerous that almost any one of the large produce stores in San Francisco has for sale more kinds than can be found in most of the cities of the Atlantic coast.

Peas are very prolific, and as a general rule the size of the berry or grain is larger than the imported seed from which they have been grown. Considerable quantities of beans are exported, but the greater demand is from the mining districts, where they are a favorite article of food.

Castor beans.—The castor bean thrives most luxuriantly in all parts of the State, except in the higher districts. It is perennial and attains the size of a small tree—say twelve to fifteen feet high, with from four to six inches diameter of trunk. It is a vigorous bearer, requires no cultivation or attention, growing wild in some places where the seed has been accidentally sown. The demand for oil on the Pacific coast is quite extensive, but up to this date supplies have all been imported. The proprietors of the linseed oil mill in San Francisco are now striving to induce the raising of castor beans to a large extent, and will probably be successful in so doing. The beans are of large size, and the picking season is extended over a period of three months, when all the grain crops have been harvested. The only drawback attending the cultivation of the castor bean is the great difficulty of eradicating it in case the ground is needed for other products. There were probably twenty acres harvested in 1866, the total yield of which has been used for seed. The prospects are fair that within five years from date enough beans will be raised in this State to supply the demand for oil along the American Pacific coast.

Chiccory.—This product has been cultivated for several years with great success in the interior. The rich low land along the Lower Sacramento proves admirably adapted for the raising of chiccory, of which it is said as many as one hundred acres have been grown in a season. Samples of the plant have been exhibited at the fairs of the State agricultural society in Sacramento city that were from four to five feet long. The manufactured article was also exhibited, and pronounced by good judges equal to any imported. The consumption of chiccory is, however, quite small, being mostly limited to the coffee roasters, who use it as an adulteration of coffee. The plant can be raised to an almost unlimited extent, there being a very large amount of land peculiarly favorable for its production in the interior of the State.

Hops.—The hop vine thrives in all parts of the State. It grows vigorously and produces abundant crops. The hops generally are of large size and good color and flavor. The climate of the interior is extremely favorable for hop-

growing, the heat of summer being so great as to almost cure the hops without the use of an oven. Ovens, however, are used to a limited extent, the curing process by them rarely exceeding twenty-four hours. The product is not only of lighter and brighter color, but, from the shortness of time in curing, possesses more of the *lupulin*, or hop dust, than is the case with the hops raised in the Atlantic States. The vine is unusually forward in producing; hops four inches in length having been obtained the first summer after planting. One of the largest hop growers in the State, Daniel Flint, of Sacramento county, gives the following information as to his crop of 1866: "I have twenty-three acres under cultivation this year—thirteen acres of old hops and ten acres planted this year. The total product was 31,825 pounds. The lightest yield that I ever had was the dry year, (1864,) which averaged about 1,000 pounds per acre. The greatest yield was in 1865, when I raised 12,000 pounds on five acres, one and a half acre of the five producing 4,600 pounds. The lowest I ever sold hops for was 15 cents per pound. This year they have been extremely high, ranging from 50 to 85 cents per pound. The usual price has been from 20 to 35 cents per pound." Mr. Flint raised his hops on bottom lands on the American river, about fifteen miles from Sacramento city. Hops, as a general rule, can be raised on all lands in the State that will produce good crops of corn. Some of the finest hops ever brought to San Francisco came from Los Angeles county. There would be very little difficulty in raising hops enough in California to supply, at fair prices, the entire consumption of the Union. Another advantage that hop growers have is the comparative immunity from the ravages of worms and the insect tribes which often seriously injure the crop in other countries. I shall dwell at length on this subject in a separate section, as it is a matter of great importance to the farmer in raising many other crops. The total crop of hops for 1866 is estimated at about 140,000 pounds.

STOCK-RAISING.

Almost countless herds of Spanish cattle and horses ranged on the vast plains and valleys of the interior, and the hides and tallow obtained from the former were the only inducements of trade that brought, in the earlier times, the ships from the Atlantic States to visit the coast. Hides were so plentiful that they were valued at one dollar each, and contracts for goods sold by trading vessels were often made payable in hides instead of dollars, specie being scarce, except in a few small places on the coast. Cattle and horses formed the great wealth of the native or Mexican population, land being so abundant, compared with the number of the people, as to have a very small value; with the exception of small patches of land at the missions, very little of the soil was cultivated, and that in the rudest manner. Cattle-raising was considered the only profitable business of the country, and as large tracts of land were needed for that purpose, the Mexican government made liberal grants when applied for. Intended for grazing uses only, and of comparatively little value, grants of large tracts of land were made loosely and with very indefinite boundaries. From this system grew the most serious evil or drawback that the agricultural population have had to contend with since California became a State, as the grants were not confirmed for many years, and from their indefinite boundaries clouded the title and prevented the settlement of from five to twenty times the quantity of land that the terms of the grants called for. As the land became valuable for settlement, every device that cunning could suggest, or fraud instigate, was resorted to by the majority of the grant-owners to delay a settlement of the survey, so that they could sell their title to land in excess of the quantity really belonging to them. In some cases surveyors were influenced to make surveys to include the most valuable land for agricultural purposes that could be found within the boundaries named. Some of these surveys were of the most irregular form that can be conceived, and their

injustice was so plainly to be seen, that they were rejected by the courts at first hearing, and other surveys ordered. Fictitious or forged grants were also frequently used to cloud the title of lands, the imperfect condition of the archives of Mexican rule favoring the success of the same. In the southern portion of the State, the grants of the Mexican government were generally of great extent, and up to the present time have been mostly held by their original owners, who have used them for cattle-raising on a large scale. Rich in cattle, these parties would not sell their land, and thereby, in great part, prevented the development of the agricultural resources of that section of the State. The great drought of 1864, which had not been equalled in intensity since 1832, destroyed the pasturage of that locality as well as others, and, as a consequence, caused the loss, by starvation, of vast numbers of cattle and horses, making the native owners of the grants poor except in land. The number of animals that died from starvation in 1864 is not definitely known, but has been variously estimated at from 600,000 to 1,000,000 head. In some cases owners lost nearly all their herds; one person in particular, who had owned 7,000 head, lost every one, and was financially ruined thereby. Out of this apparently great calamity much good will result, as it insures the sale and subdivision of large tracts of land that will hereafter be made productive and of benefit to the State. The destruction of the vast herds of Spanish cattle and horses also opens a profitable market to the farmer, who can now raise a few head of good cattle and horses annually for sale, which he could not do successfully in previous years. American stock, more or less graded with Durham, Devon, and other valuable breeds, is becoming quite general, and the probabilities favor the assertion that, within a decade of years, the average character of cattle in this State will compare favorably in value with those of any other portion of the Union. The same remarks apply to horses, which are improved every year by the mixture of fine-blooded animals, imported or brought from the Atlantic States. Our farmers have now generally come to the conclusion that a valuable animal can be kept or bred as cheaply as an inferior one. Sheep were of comparatively small numbers in the State under the Mexican rule, and were difficult to preserve from their natural enemies, the wolves, who were to be found in vast numbers all through the land. The great influx of Americans in 1849 and 1850, soon exhausted the supply, and also made serious inroads among goats, great numbers of which were killed, and sold for mutton in the principal towns and cities. An inferior variety of sheep was early brought in vast droves from New Mexico, for meat purposes, to supply the demand. Being very profitable, the business soon became overdone, and it was found desirable to raise a breed of sheep that would be valuable on account of the quality of their wool. All the fine-wooled varieties of sheep known in the United States and Europe were imported and crossed with the common stock, and improving the breed has continued, the poorer animals being killed off for market, until at the present time hardly a common sheep can be found, and the general quality of the wool crop compares favorably with that of many of the older States of the Union. The climate and grasses of California are well adapted to sheep-raising, the diseases common in many other places being scarcely known, and the annual increase of animals peculiarly large. Further mention will be made of this in speaking of the wool crop of the State.

Swine.—These animals thrive well in California, and are, so far as known, free from the diseases which have been so prevalent of late years in the Atlantic States. The fertility of the soil makes the raising of hogs cheap and profitable, and their numbers could soon be increased, if required, to an almost unlimited extent. Barley is so cheap that it is used almost exclusively in hog-raising, as corn is in the western States. This feed makes sweet, firm, and very fine-looking pork, which, for quality, will compare favorably with any produced in the other States. With the exception of a comparatively small quantity of salt pork and hams and sides, mostly imported in brine from the Atlantic ports, the domestic

production supplies the home demand. But few years will pass before importations will cease entirely, and California become a large exporter of salted and cured meats to countries on the Pacific coast, and to the interior.

Poultry.—All the domestic fowls thrive well and increase rapidly in California. Turkeys, chickens, geese, and ducks, as also their eggs, sell at profitable prices—the consumption of these varieties, as well as other animal food, being more general in California than in the Atlantic States. In this particular the people, in their habits of diet, are peculiar—meat of some kind, with comparatively few exceptions, forming the main portion of every meal. In addition to the above named animals, the entire State teems with small animal life, native to the country. Every variety of geese, ducks, swans, cranes, snipe, quail, grouse, and other wild birds, can be had, in the winter season, in almost unlimited quantities. Hares, rabbits, and some varieties of squirrels, are abundant in all sections of the country; in some places injuring trees and grain crops by their depredations. In some districts game animals and birds are so abundant as to form quite important items of food.

DAIRY PRODUCTS.

In dairy products California has hitherto been largely in arrears toward supplying the wants of her own people. Up to the present time, thousands of firkins of butter are annually imported, as also a considerable quantity of cheese, from the Atlantic States. The high prices for these articles, however, have encouraged dairying, so that in 1866 the production of butter and cheese had increased sufficiently to supply the greater part of the domestic demand. There is yet a large field for this business besides the local consumption, as the State of Nevada, and portions of Utah and Montana Territories, have to derive their supplies from California. The demand in these cases, and more particularly of Nevada, will continue, and in a few years, when the country is properly developed, be largely increased. The business can be prosecuted on a large scale, and prove more profitable, in proportion to the capital invested, than is the case in the Atlantic States. With the advantage of prices constantly high, the dairyman incurs little or no expense to provide fodder for winter, as cattle, with other animals, run at large and feed themselves, without housing. As a general rule, however, it is considered prudent for farmers to save and stack a portion of their straw of the threshing, so that their cattle can, if the winter proves unusually cold, have some food to eke out the scant pasturage which would otherwise be their only support. The greater portion of the butter and cheese produced in the State is made in the north coast districts, the climate being milder, and the grass lasting longer into the summer.

HONEY BEES.

Since the introduction of bees from the Atlantic States raising honey has been found a most profitable business to engage in. Besides the making of large amounts of honey annually, which brings very remunerative prices, the bees swarm to a degree not known in the other States of the Union. Instances have been known where, from a stock of five strong hives in the spring time, forty hives, with strong, healthy swarms of bees, were had before the commencement of the rainy season. In the business of honey-making it is believed that California has no superior in the known world. With ordinary care and attention, bees can be raised free from disease, and yield at least twice the quantity of honey during the season that can be had in the other States.

GREEN FRUIT.

To the inhabitants of the Atlantic States the statements of the early bearing of trees, their prolificness, and size of products, in California, will, when compared

with those of older States, seem to be exaggeration or boasting. Many varieties of trees bear in their second or third year from planting, the fruit being, as a general rule, of extraordinary size, and in great quantity. Apples and pears of all varieties do well in almost every section of the State, with this peculiarity: that what are elsewhere considered autumn fruits, mature in summer, and winter fruits in autumn. This is caused by the mildness of the winters and forwardness of the season. The same remarks apply to almost all other varieties of green fruit, which, maturing earlier, naturally go out of season proportionately sooner. Peaches grow well, and are to be had of a size and flavor that cannot be surpassed elsewhere. In some districts the curled leaf disease has prevailed, but has not so far caused great damage, considering the large number of trees and their imperfect culture. Quinces grow to a size and have a flavor not exceeded in any country. Plums are produced in great quantities, their abundance being so great as often to break down trees by the weight of fruit. Prunes of all kinds, so far as tried, have done well. Cherries are of extra size, the trees healthy and great bearers, and are a most profitable fruit to raise. Nectarines and apricots, of unsurpassed appearance and flavor, are also produced. The following are the largest specimens of the above fruits exhibited in San Francisco, viz: Apples, (Gloria Mundi variety,) 32 and 34 ounces; pears, 84 ounces; plums, 7 ounces; apricots, (Moorpark,) 16 ounces; peaches, from one-third to one-half size larger than the same varieties cultivated in the Atlantic States. All of these fruits are free from the ravages of insect life.

SEMI-TROPICAL FRUITS.

Oranges of fine size and flavor are to be had in all parts of the State, ripening from November to April. The crop is a most favorable one, as the trees bear unusually full, while the fruit finds a ready sale at remunerative prices. Lemons of three varieties are grown in the southern coast district, viz: the California, or native lemon, which is of large size, and apparently a cross or hybrid with the citron, having the thick rind of the latter with the flavor of the lemon; and the Malaga and Sicily lemons, grown in the same district, from the seed, produce unusually large and fine fruit, and bring profitable prices. Limes of unusually large size and good flavor are produced in the same localities. Citrons of unsurpassed excellence and size are to be had in the south coast district, but are as yet only valued for their perfume or aroma and beauty. It would be an easy matter for California, say in eight or ten years, to supply the entire Union with the preserved citron of commerce if proper efforts were made to do so. The fruit is of unusually large size and perfectness. For the purpose of giving some idea of the cultivation of the above semi-tropical fruits, I give the statistics of the crop of 1866, and size of specimens brought to San Francisco: Oranges, about 250,000. As many new trees have just been set, and others are coming into bearing, parties well informed in the trade estimate that the crop of 1867, unforeseen drawbacks excepted, will be at least double the above quantity, all from the vicinity of Los Angeles. For richness of coloring and flavor these oranges are not equalled by any fruits imported from the Hawaiian and Society islands, Lower California, Mexico, Central America, or Panama. The total consumption of this fruit in 1866 was about 3,000,000. California-grown oranges range from six to twelve ounces each. Lemons of the three varieties, of which the native lemon, although of large size, is the poorest and little used, range in weight from eight to sixteen ounces each. Fruit raised from Malaga and Sicily seed grows to an enormous size, compared with that which is imported. Specimens of the Sicily variety have been grown averaging twelve and thirteen ounces each, taken indiscriminately from boxes on sale. The Malaga variety is also of large size, but somewhat smaller than the Sicily. The crop of 1866 was about 40,000, all from

the vicinity of Los Angeles. Limes are of twice the size of the average imported fruit. Many specimens have been had this season weighing four and five ounces each. The total crop for 1866 was about 60,000, which will probably be doubled in 1867, as will also be the case with the Malaga and Sicily lemon. Of citron, not over 4,000 to 5,000 have been marketed this year. Those sent to San Francisco ranged from twenty to forty-six ounces each.

DRIED FRUITS.

Figs of all the varieties known in the civilized world thrive and bear well in California, being produced in all parts of the State in the valley lands. The native fig is of a purplish black color, with a blue bloom, and is a hardy fruit, bears profusely, and is cured in considerable quantities. The extent of the crop is not definitely known, as it is scattered all over the State; but good judges estimate it at about fifty tons weight. The large Turkey white fig has been introduced, and the fruit being of large size and fine flavor, is mostly consumed in a green state. The fruit of the first crop of this variety, marketed in San Francisco, averaged from three to five ounces weight each. The price paid for table use is so great that the larger portion of the crop is sold by producers without curing. So far as known, no dried figs of this variety have been made, other than small lots from the second crop for private use. Their quality is said to have been of superior excellence. The Italian and other varieties of this fruit have done well; but the production of all the white and brown varieties has as yet been quite limited. Enough, however, has been cultivated to prove that large quantities could be produced by propagation and ordinary care. Prunes have already been mentioned in connection with green fruits; but it is proposed that their importance as a dried fruit should be stated. The German prune is a good bearer, the fruit being of good size and flavor, and much used without curing. There are quite a number of French varieties of prunes cultivated, which, when dried, make excellent fruit. The long or Bordeaux prune, which is such a favorite with the American public, is not as yet introduced into California. The crop of dried prunes of all kinds made in 1866 was about thirty-five tons weight. Of the round, French prune, one man in the vicinity of Petaluma made twelve tons, the fruit being very large, pulpy, and toothsome. From the attention which the cultivation of the prune has attracted, it is probable that, in a very few years, the fruit will be cured in sufficient quantities to admit of exportation to the Atlantic States. While on the subject, it is proper to state that comparatively large quantities of apples, pears, plums, peaches, nectarines, and apricots have been dried in 1866 for domestic consumption. Zante, or black currants, have been made this year from the black Corinth grape. The quantity made was very small, but it has demonstrated clearly that fruit of superior quality can be made, and its culture be profitably engaged in. The black Corinth, or seedless grape, is a vigorous grower and prolific bearer. For quite a number of years attempts had been made to introduce the vine into the State, and considerable money spent in so doing. A great many cuttings and rooted vines were imported by various parties, who subsequently found that deception had been practiced on them, the fruit proving to be of other varieties. Several persons have been at last successful in getting the true vine, and its culture will be prosecuted in all portions of the State as soon as cuttings in sufficient quantities can be had. A sample of this fruit will be sent to the Department of Agriculture for exhibition. Compared with the imported fruit, that raised in California is of somewhat larger size, has very little sugar, but a more decided currant flavor, is cleaner, and of a more uniform black color. Before the end of the present century it is very probable that the production of this fruit in California will be sufficient to supply the entire demand of the Union.

Raisins have been made in considerable quantities in the State during the last four years. Those produced from the Feher Szagas, or Fiher Zagos grape, (Hungarian,) are considered by good judges as superior in every respect to the imported or Malaga fruit, with the exception of size of berry and deep bloom. The Fiher Zagos raisins are of a light red color and white bloom, of medium size, have a thin skin, tender pulp and seed, are of pure, sweet flavor, and free from the musky taste that is common in all imported fruit. This grape was brought from Hungary to California in 1853 by a native of the former country. From two small cuttings, or roots, at that time, the culture has spread until there are now probably 50,000 bearing vines, and at least 300,000 cuttings and roots planted, all of which will be in full fruitage in 1870. The vine is a most prolific bearer, averaging, in the largest vineyard in the State, from thirty to forty pounds per vine, at six years of age. Prior to 1862 the grape was confined mostly to one vineyard, situated in the edge of El Dorado county, about a mile from Mormon island, a noted gold-mining locality in earlier days. In that year, B. N. Bugbey, ex-sheriff of Sacramento county, saw the grape, and, drying it, found, as the result, raisins of a very superior quality. Purchasing the vineyard, he at once commenced propagating the vine. In 1863 he made the first public exhibition of raisins, and from 200 boxes, or 5,000 pounds, in that year, increased the amount to 1,500 boxes, or 37,500 pounds, in 1866. The vine is trimmed (like others in California) in the shape of a low bush or tree, the main stalk not averaging eighteen inches above the ground. The young wood is staked up to about four feet high, and the runners pinched in during the summer so as to throw out lateral shoots, the leaves of which protect the fruit from the rays of the sun.

Considerable discussion has been made, by several noted viniculturists, as to the derivation of this grape; some contending that it is a variety of the "Larga" family, or Malaga raisin-grape, of which the white Muscat of Alexandria is a member. From personal comparison with the White Malaga, Muscatel, and White Muscat of Alexandria grapes, in the same vineyard, I am satisfied that the Fiher Zagos grape is a totally distinct variety, varying in shape of leaf, color of fruit, bloom, shape, and size of berry, and bunch, tenderness of skin, pulp, and seeds, and a perfect freedom from all trace of muskiness, which is plainly perceptible in all the other grapes named. The grape is also most excellent for table use, but is too tender to bear long transportation. A very fine variety of golden-colored wine is also made from it, which in flavor is between sherry and Madeira wine. The fruit grows in long bunches, with many spurs from the main stem, the berries being of oblong shape, light green translucent color, and varying in size from the middle of the bunch down. Considerable quantities of raisins have been made from the Muscat of Alexandria grape; but besides the musky flavor, as far as I have seen, they have an inherent disposition to absorb moisture and ferment. The White Chasselas, and other kindred grapes, have also been dried; but as they are without any perceptible pulp or sweetness, with tough skin and large, hard seeds, they have not met a profitable market. Large quantities of mission or California grape have been dried, and, being pulpy and of pleasant flavor, are proving an excellent substitute for the usual second quality of raisins used for cooking purposes on board shipping. The total crop of raisins and dried grapes for 1866 is estimated at about forty tons weight, nearly one-half of which were from the Fiher Zagos grape. As this variety is a most excellent keeper, besides its other good qualities, it is being propagated largely in all portions of the State, about 300,000 cuttings having been sold by one cultivator this year, to be delivered in planting season of 1867. From present appearances, it seems probable that California will be enabled to supply the entire Union with raisins before the close of the present century.

Olives thrive well in every portion of California where they have been planted. The French olive, however, which is common in some portions of the State, is

of small size and quite bitter, and makes an inferior quality of oil. The Seville, or Spanish olive, is as yet of limited cultivation, and mostly confined to the south coast district. Being a slow fruiter, very little attention has been attracted to the cultivation of the olive among our agricultural population, who, as a general rule, are not disposed to plant any tree or vine that does not bring a speedy crop. The notices of the public press upon the value of the olive tree for fruit and oil have attracted much attention during the past year, and many farmers are now disposed to plant a few trees as a venture. It is probable that, if no change takes place in the present feeling of farmers, the cultivation of the olive will become of considerable importance within the next ten years.

NUT FRUITS.

All varieties of nut fruits, so far as tried, have been found to thrive, and bear well in most portions of the State. Almonds of Ivica, Languedoc, Princess, paper shell, and Marseilles hard-shell, have been grown, producing fruit of most excellent quality. As a rule, the shells of all nut fruits grown in California are thicker and harder than those of similar fruits grown in Europe and the Atlantic States. Almonds are a very profitable crop when care is taken in curing them of a bright color, and the tree is being largely propagated in almost all parts of the State. A variety of walnut, native to some portions of California, resembles greatly the black walnut of the eastern portion of the Union. The shape of the nut is the same, as also its inside formation; but the outer surface is only veined, instead of being rugged or rough, like the black walnut. It is mostly found along the Lower Sacramento river, and in a few small valleys of the north coast district. Growing rapidly, and making a very ornamental shade tree, of good wood, the tree is now much propagated by farmers. The flavor of the meat partakes of both the black walnut and butternut of the western States. Madeira nuts, or English walnuts, are cultivated in all portions of the State, being, however, most plentiful in the vicinity of Los Angeles, in the south coast district. The tree bears in from six to eight years; is of fine appearance; good quality of wood for cabinet purposes; while the fruit, being superior in quality to that imported, brings profitable prices. The tree is a vigorous bearer at ten years of age, often producing 100 pounds of nuts, and at thirty years old is said to have borne 1,000 pounds in one season. The cultivation of the Madeira nut is largely engaged in, in almost all of the valley counties, and the probabilities are that the production will supply the home demand in a very few years. Pea-nuts prove a very profitable crop to producers, the yield, in favorable seasons, averaging from 150 to 200 bushels to the acre, in suitable localities. The nut in California is, on an average, double the size of those produced in the Carolinas or on the coast of Africa. The crop of 1866 was about 200 tons, and mostly grown on the low land of Yolo county, on the lower Sacramento river. The cultivation of chestnuts, so far as tried in the State, has proved successful; but few trees have as yet produced fruit, and those, so far as known, are situated in the Sierra Nevada district, near Placerville, in El Dorado county. The tree is being grown in quite a number of counties, and it is probable that its culture will prove extensive in some sections of country where the native timber is becoming scarce. The variety now cultivated is the same as that grown in the Atlantic States. Attempts have been made to introduce the Japanese chestnut, which is of the same size and variety as the Italian, but I believe thus far without success. The inauguration of regular steam communication with Japan will probably admit of bringing small trees in safety from that country, in which case but a short time will elapse before the cultivation of this variety of nut will be largely engaged in. Hazel-nuts are native to California. But little attention has been paid to them, and very few collected for sale in San Francisco

It is believed that the filbert nut could be grown to good advantage, and it will probably be introduced before many years have passed.

BERRY AND OTHER SMALL FRUITS.

All the berry fruits grow prolifically in California. Strawberries of some varieties are to be had grown in the open air from March to November, and from hot-houses the balance of the year. . They are almost constantly on sale in the markets of San Francisco. The fruit is of remarkable size, those of the British Queen variety having been grown fifteen berries to the pound, while the white Chili variety has produced berries of nearly three ounces in weight. Raspberries grow of fine size, and superior in flavor to those produced in the Atlantic States. Blackberries are most prolific bearers, with fruit of extra size and flavor. Huckleberries have so far been of very limited cultivation, their place in the market being mostly supplied by a variety of small blueberry that is a native in some localities of the north coast district of California. There are also some varieties of native berries found along the coast from Mendocino county to Oregon, called salmon, squaw, and other berries, which are said to be of excellent flavor. The cultivation of the cranberry has been repeatedly attempted, many thousands of roots having been imported from the Atlantic States and Washington Territory; but none of the domestic fruit has yet been produced in this market. Red, white, and black currants have been grown to considerable extent, and have always brought remunerative prices. The red cherry currant in particular has been raised of very large size, the berries in some cases being as large as ordinary sized grapes in the Atlantic States. Gooseberries do well, but as a general rule the berries are smaller than those of the same varieties in other countries.

VEGETABLES.

All the varieties of vegetables known to the Atlantic States and Europe thrive well in California. Many of these vegetables, as before stated, are grown in the open air, and are gathered in every month of the year, and as a general rule are equal and in some cases superior in quality to those of the Atlantic States, while the size is also much larger. In order that comparisons may be made by others, I give the following weights of the largest specimens grown in the vicinity of San Francisco, viz: Irish potatoes, 7 pounds; sweet potatoes, 26 pounds; beets, 135 pounds; cabbage, 56 pounds; turnips, (white,) 26 pounds; turnips, (yellow,) 14 pounds; carrots, 31 pounds; onions, 2½ to 4 pounds; tomatoes, 2½ pounds; watermelon, 34 pounds; a pumpkin, 350 pounds, which, with five others grown on the same vine, weighed 1,900 pounds; crooked neck squashes have been grown weighing from 96 to 110 pounds. Of the prolificness of the potato, it is a matter of undisputed record that a Mr. Hill, of Pajaro valley, in 1855, raised from the cuttings of a single large potato, 853 pounds merchantable weight, which were exhibited in San Francisco. There is scarcely a vegetable known that is not produced of larger size than is grown in the Atlantic States. The great production of most of these vegetables is mainly confined to the north coast district, the intense heats of summer in the interior valley district preventing their successful production, except in the early portion of the year.

TEXTILE FIBRES.

Cotton, of the short staple variety, has been grown to a considerable extent in the interior portions of California. For a long time the theory advanced by one or more prominent agriculturists in the State, that cotton could not be successfully grown, in consequence of lack of humidity of climate, prevented attempts at its culture. In 1865, however, experiments were made, mostly in Tulare and

Los Angeles counties, some 450 to 500 acres being cultivated. The theory that the plant necessarily required a large amount of moisture led planters generally to irrigate them when in bloom, which was attended with most disastrous results. The bolls which had partly formed fell off and new ones took their place, the latter not maturing well before the rainy season set in. As a result, but a comparatively small amount of cotton was gathered—the total crop of 1865 not amounting to over 60,000 pounds when ginned. The planters saw the mistake when too late to remedy it that season, but felt encouraged to plant and cultivate in a different manner the succeeding year. I have been unable to ascertain, with any degree of accurateness, the number of acres planted and quantity of ginned cotton raised in 1866, planters when applied to by letter evading replies in answering, or neglecting in some cases to write at all. As a class, the present planters are very reticent in giving any information regarding their experience, some of them at the present time having still on hand a portion of the cotton grown in 1865. Enough, however, is known to prove that cotton can be cultivated at a profit by white labor in California. The following instance of the crop of 1866, which I have from a reliable source, illustrates the ease with which cotton can be grown:

Two men emigrated from Missouri in 1865, and took up a quarter section of land in the vicinity of Vizalia, Tulare county. Neither of them had ever engaged in cotton-growing, their only knowledge being derived from a person who had travelled through the southern States, and had seen it growing there. They ploughed some sixty acres of land in February and March, and early in April planted, and afterwards gave the crop one hoeing. Being in reduced circumstances, one of the men went off to some distance to work while the crop was growing, and the other hired out in the neighborhood of the farm. The plants were not irrigated, nor was any work done on the crop until it was gathered. During the summer an irruption of grasshoppers destroyed thirty acres of the crop, but the balance of the land (thirty acres) turned out a little more than 6,000 pounds of first quality, short staple, ginned cotton. Parties who have formerly been engaged in cotton-raising in Tennessee and Mississippi, and are conversant with the experiments in growing cotton in California, state that it can be grown cheaper with white labor here than with slave labor there, owing to the absence of crab grass and other weeds, which there necessitate constant labor in cultivation to prevent the cotton plant from being destroyed. The long rainless summer season also admits of gathering the crop without injury, and frost is rarely experienced until December. The total amount of land planted in cotton, in 1866, is estimated as somewhere near 400 acres, mostly in 20-acre patches. It is reported that there are from 15,000 to 20,000 acres of good cotton land in Tulare valley and its vicinity, and much larger amounts in the other portions of the State. It is believed that the long staple, or Sea Island variety, could be successfully and profitably grown in the southern coast district; but, so far as known, it has not been tried. In 1863 I was shown a sample of cotton gathered in the mission of San Gabriel, Los Angeles county, which was supposed to be a wild variety. My informant stated that it was produced by a tree some fifteen to twenty feet high, the trunk or main stem being some seven or eight inches in diameter. The cotton was much discolored and injured from lying on the ground after rain, and I could not judge of the value of its staple, which was very fine and quite long. The seeds, however, were of the Sea Island kind, being smooth and black. Subsequently, on visiting the Sandwich or Hawaiian islands, I found that the Sea Island cotton there became a perennial, growing to the size of a small tree, bearing crops every year. I therefore think that in all probability the tree reported at San Gabriel is from the Sea Island seed, the more especially as there are occasionally winters there without frost. Should my view in this matter prove correct, it is very likely that California will in time take rank with the secondary cotton-growing States in the Union.

Flax, wherever planted, has so far produced good crops of seed. The valleys of the north coast district seem to be peculiarly favorable to its successful culture, but there is very little or no doubt that it could be profitably grown in almost all parts of the State, as it is found growing wild in the Sierra Nevadas from 2,000 to 2,200 feet above the level of the sea. There is a very large demand for seed for oil purposes, but there is also an immense demand for its fibre to manufacture bagging for grain and wool. Parties are now organizing a company which will engage in manufacturing bagging as soon as the culture of flax becomes extensive enough to warrant the investment. Hemp of good quality has been grown in Russian River valley—in Sonora county. It is said that it produces largely, and can be grown at very little expense.

The extensive culture of this product will be engaged in, no doubt, as soon as a market for it can be had. I have been informed that a species of nettle vine, which grows wild near Santa Cruz, possesses a remarkably fine, long, and strong fibre. It is said to be of great fineness, pliable and glossy like silk, and extends the entire length of the vine, specimens having been procured thirty feet in length. I have endeavored to procure samples of this fibre to send for exhibition in the department at Washington, but have so far been unsuccessful.

WOOL-GROWING.

California possesses a soil and climate admirably adapted to the growing of wool. The indigenous grapes of the country are all very nutritious, while the long, dry summers and mild winters admit of the raising of sheep without a tithe of the expense and risk which is common in the other States of the Union. The original stock of sheep, as before stated, was of very poor quality for producing wool, but in the last twelve years it has been so crossed or bred with fine sheep, imported from the Atlantic States and Europe, that the original stock has nearly disappeared. All varieties of blooded sheep have been imported, but the French Merino has been most largely used, and the greater part of the wool crop is more or less crossed with it. Spanish Merino, Saxony, Cotswold, Southdown, and other varieties are in considerable numbers, but they form a small proportion of the whole, and are not propagated as generally as the French Merino. There are two wool crops during the year, viz., the first, or spring shearing, in May, which produces the longest wool, and the second, or fall shearing, in September. The second shearing produces a shorter wool, the great bulk of which is exported to Atlantic ports. The two shearings are caused by the necessity for getting an average strong staple, as during the heats of summer the wool ceases to grow for a time. The result is that when it grows again there is a weak spot in the fibre which injures it for spinning. Another cause which also contributes to the two shearings is the prevalence of a species of wild clover in some portions of the State. This clover while green makes excellent feed, but its seeds when matured are contained in spiral burrs, which, from their corkscrew shape, cannot be readily got rid of when entangled in the fleece. By shearing early in the spring the evil of burrs, as well as the seeds of the alfilerillo, which are long but spiral, are mostly avoided, and the wool marketed in a comparatively clean state. The fleeces of California wool are seldom washed before shearing, and therefore contain a very large percentage of dust and grease, the loss in weight averaging from 40 to 65 per cent., according to condition, in scouring. The spring crop of wool for 1866 was 4,934,950 pounds; the fall crop, 2,244,550 pounds, and 754,587 pounds pulled wool during the year, making a total of 7,934,087 pounds, of which the local factories of San Francisco bought 3,189,500 pounds, while 4,662,129 pounds were exported, mostly to the port of New York. The quality of the wool put up in 1866 showed a marked improvement in both fineness and cleanness on previous clips, and it is believed that in a few years more our wool will compare favorably with that of any other State in the Union. The spring

clip for 1867 is estimated at about 7,000,000 to 7,500,000 pounds. This estimate is based upon an increase of 100 per cent. in lambs, less 20 per cent. killed for market, or 240,700, and 15 per cent. of wethers, or 212,380, all butchered in 1866, making a total of 453,080 sheep taken for the above purpose. The average fleeces are put down at three and a half pounds each, or 7,582,000, which with proportionate fall clip will make the total crop of 1867 amount to nearly 12,000,000 pounds, pulled wool included. The wonderful fecundity of sheep in this State promises in a few years, if no season of drought like 1864 intervenes, or no epizootic disease breaks out among them, to make California one of the greatest if not the most important of the wool-growing States. There is a vast amount of land not cultivated at the present time which is well adapted to sheep-grazing, and, as woollen manufactories are on the increase, the home market for wool will stimulate wool-growing by increasing its profits. The consumption of wool in 1867 promises to keep pace with the increased production, as one first-class mill, which will consume nearly a million of pounds, and another requiring nearly half that amount, have just been built in San Francisco. Another woollen mill is in process of construction at Marysville, and projects for the erection of others at points in the interior are being extensively canvassed by capitalists. With the opening of the steam line to China and Japan, our manufacturers will in all probability find a new and profitable market, which, with the aid of cheap Chinese labor, they will be able to supply in competition with manufacturers of the Atlantic States. There are also many new branches of woollen manufactures that the domestic consumption on the Pacific coast will in a few years induce capitalists to invest in, the more especially as additional markets for the same articles are to be found in British Columbia, Mexico, and some portions of Central America, to which our steam communication now gives us ready access. All these things considered promise to stimulate wool-growing to a very great extent by making it profitable.

SILK-GROWING.

The business of silk-growing has already assumed considerable importance in California, and promises, in a very few years, to attain dimensions that will attract the attention of the civilized world. The soil and climate of this State seem to be peculiarly favorable to the growth of all varieties of the mulberry tree. The climate, from its dryness in summer and freedom from thunder-storms, is said to be better adapted to the culture of silk-worms than any other country. These advantages early attracted the attention of several persons, who were further stimulated by the fact that an indigenous worm had been found in some portions of the State spinning cocoons resembling a coarse silk. In the spring of 1854, L. Prevost, in connection with Henry Heutsch, a banker of San Francisco, imported a considerable quantity of mulberry seed, which was planted, and produced fine trees. Efforts were made to import silk-worm eggs from China; but they, on three different occasions, proved to be bad, only a few of the last lot hatching. Another lot of eggs, however, was imported from France in the spring of 1860, by Mr. Heutsch, which proved to be healthy, and hatched finely. These worms produced fine cocoons, specimens of which were sent to France, and there pronounced of the first quality. The culture of silk then began in earnest, and has been continued, and increased nearly a thousand-fold, up to the present time. No disease of any kind has been found among the worms when fed with fresh food. They now bear so high a reputation for healthfulness, that orders for eggs from France and Mexico have been received, for several years past, far in excess of the ability of silk growers to supply. From the planting of a few thousand trees in the vicinity of Santa Clara, and the raising of a few thousand worms, the business has spread so that hundreds of thousands of the various kinds of mulberry trees have been planted, and millions of cocoons

raised. Silk-growing is largely engaged in in various sections of the State, and in every case the worms have proved healthy, and made fine cocoons. The process is so simple that no difficulty has been experienced by parties growing silk for the first time. Mr. Prevost states that not only is the process simple, but the circumstances of climate are so favorable, that one person in California can attend to as many worms as require eight persons in France. The mulberry, thriving finely, with the cheapness of land in this State, he asserts, makes a greater difference than the higher price of labor. From his experience, Mr. Prevost claims that silk can be produced in California so as to pay a fair profit, and enable the grower to undersell the product of the cheapest labor country that produces silk. A vast demand exists for eggs, which can be sold in quantities of 100 pounds or more, at $12 per ounce (cash) at place of export. The feeling of the agricultural public is so favorable to silk-growing, that it is very probable it will soon hold high rank among the important productions of the State. A silk manufactory has been established in San José, and a number of pieces of dress silks and other goods made, which, for lustre, beauty, and fineness, are said, by good judges, to compare favorably with the best quality of similar articles imported.

TOBACCO.

Tobacco has been grown in most of the valley counties of the State, and has invariably given a fair yield. The quality of the leaf, however, has varied greatly, according to locality and knowledge of curing by the party raising it. In the first years of the late rebellion, very large quantities of tobacco were raised, but the greater portion of it was badly damaged in curing, much of it resembling weeds or hay, having no true tobacco flavor. When grown on rich, low land, the plant produced a thick, coarse leaf, with a sort of down on the under side, and had considerable gum when dried. When grown on drier places, the leaf was fine, but of very light weight, fields not averaging two-thirds the weight of cured tobacco that the same appearance would realize in the Atlantic States. Considerable good tobacco was produced in Santa Clara, Colusa, and Napa counties, some of which was manufactured into excellent twist and plug for home consumption. With proper knowledge of cultivation and curing, a very fine article of smoking and manufactured chewing-tobacco can be had, in quantities to supply the demand on the Pacific coast. At present the cultivation of tobacco has dwindled to quite a small amount, and very little inducement in price is offered to planters to increase their crops.

SORGHUM.

The Chinese sugar-cane, or sorghum, has been cultivated to a comparatively large extent in previous years. The difficulties attending the making of sirup by new hands, and the large expense entailed by way of machinery and pans, has been a great drawback in its culture. So far as known, no sugar of consequence has been made, and, as a general rule, from the ignorance of those making it, the quality of sirup offered in this market has been quite inferior and slow of sale, at unremunerative prices. A very large amount of land is well adapted to its cultivation; the cane, wherever planted, growing vigorously, and yielding an abundance of juice.

SUGAR BEETS.

The great consumption of sugar on the Pacific coast is stimulating its production, and efforts are now made to inaugurate sugar-beet culture by the gratuitous distribution of seeds to farmers. It is intended, by one of the proprietors of the sugar refineries in this city, to remove his works to the vicinity where the sugar-

beet produces the most sugar per acre, and engage in its manufacture. The seed will be sown quite extensively in different portions of the State in 1867, and samples of the beets produced forwarded to San Francisco for testing. There is very little doubt that sugar-beet culture will prove successful, and become of great importance in the list of staple productions.

SUGAR-CANE.

It is by no means decided that the cultivation of the sugar-cane cannot be profitably engaged in, as is the case in Louisiana and other sugar-producing States. By the aid of steam lines to the Hawaiian islands and Mexico, fresh cane can be brought to San Francisco for planting, which could be renewed every year, if required. I have been credibly informed that B. D. Wilson, of Los Angeles county, in 1857, planted a patch of about forty acres in sugar-cane, imported from Mexico. The canes were planted in June, and grew finely; but before cutting, in December, a sharp frost came, and destroyed their value for sugar. About two or three acres were cut and boiled in ships' try-pots, the result being an inferior quality of sirup, which was sold to Indians and Greasers. Disgusted by the result, and wine-making being very profitable, Mr. Wilson planted the ground with vines, and abandoned all further attempts at sugar-making. A very large quantity of land can be had in the south coast district suitable for cane-growing, if its profitableness can be once clearly demonstrated.

RICE.

This grain has not as yet been grown in the State, although large sections of country along the Lower Sacramento and San Joaquin rivers, and tributary streams, are eminently adapted to its cultivation. These lands, known as "tule" lands, are extremely productive when reclaimed, and would undoubtedly produce very large crops of rice. An additional incentive to the cultivation of this grain is the immense consumption by Chinamen, of whom there are some 60,000 in the State, with a prospect of the number being soon largely increased by additional immigration, as cheap labor will be required for the prosecution of public works. The annual consumption of rice on the Pacific coast, which is supplied through the single port of San Francisco, amounts to about 40,000,000 pounds. Land suitable for rice-growing can be bought of the State for $1 25 per acre, with a long credit, to enable the purchaser to reclaim it. This is done by levees, at comparatively small expense; and the land, in two years' time, produces as large average crops of grain as can be had in the other districts.

Public attention has been attracted to rice-growing, and it only needs the successful cultivation of a single acre to induce the planting of thousands of acres the following seasons. This will undoubtedly be done in a few years, when, if successful, a new and important product will be added to the agricultural wealth of the State. Persons who have seen rice growing in the Carolinas, state that the culture of this grain can be carried on at half the expense, per acre, in California. An additional advantage in its cultivation is to be found in the skilled labor of the Chinese, who can be had in numbers at low pay.

NUTMEGS, TEA, AND PEPPERS.

A species of the nutmeg tree is indigenous in some portions of California. The fruit is longer and smaller than the imported nutmeg, and also has a smoother coat or covering, the nut in appearance resembling the pecan nut of Texas. The flavor of the native fruit is similar to the imported, but possesses less essential oil and strength of aroma. This nutmeg was only once on sale in San Francisco, which was some years since, when the imported fruit was entirely out of the

market. I am unable to give any definite information as to the locality and number of trees, &c., as I made no memoranda at the time; I am, however, convinced that the imported nut could be successfully grown in California, and pay a fair profit to producers. The culture of the tea plant has been repeatedly attempted, but the seed or nuts sent from China have, with the exception of one case, failed to germinate. The nuts that were alive were raised in a hot-house, in San Francisco, with great difficulty; but the plants, at the end of a year, seemed in a thrifty condition for transplanting. This was done by potting them; but being exposed to unusually cold and windy weather, the plants all died. With direct steam communication of less than thirty days' voyage from the Chinese and Japanese tea ports, it is highly probable that plants in vigorous condition can be imported from those places, and prove a success. The hillsides and valleys and the climate of the north coast district would seem to be well adapted to tea-growing, and, if the plants can be safely imported, may, in time, prove a large tea-producing section of the State. The pepper tree of commerce is said to have had a single representative in California a few years since. My informant, who is conversant with grain black pepper, stated that the grains of the California tree were similar in shape, size, and pungency to the imported grain.

TIMBER TREES AND THEIR PRODUCTS.

The timber trees of California are of considerable number, and are an important source of wealth to her people. The Sierra Nevadas are clad for hundreds of miles with heavy forests of pine, fir, and cedar, which, as a general rule, can be transported only at great expense at the present time. Vast quantities of lumber, however, have been used in mining towns and mining operations, while some of the finer timber, such as sugar pine, has been hauled from the most accessible places to towns in the interior, remote from cheap water communication. Along the coast from Monterey to the borders of Oregon, a belt of various kinds of timber trees is found, from which the great supplies of San Francisco, Sacramento City, and the farming districts around the bay of San Francisco are derived. The lumber most in demand is known as redwood, a species of red cedar, which is found along the coast from Santa Cruz to Trinidad. At Monterey a species of cypress is found, which is said to be the only tree of that variety in the State. At Humboldt bay the prevailing woods are white fir and pine, which are much used for fencing. At Port Orford and Coosa bay is found a species of yellow pine, and two small belts of white cedar, not found elsewhere in the State. Another species, resembling the Georgia yellow pine, is found all along the coast from Monterey to Oregon. The trees grow to a monstrous size, in some cases redwood having been found sixteen feet in diameter, and some of the other varieties ten feet in diameter at the butt. Of the redwood variety, the museum of the department at Washington contains a specimen of redwood plank, from Albion river, which is seven feet five inches wide, free of sap and clear of knots. The sugar pine of the interior is also found of large size, and, with Port Orford cedar, is valued very highly as a good substitute for the white pine of the Atlantic States, and is used in all fine woodwork. A most excellent variety of hard wood, termed laurel, is found in considerable abundance in the interior of the State. Large quantities of this wood were used for fuel until its excellence for cabinet and furniture manufacture was discovered a few years since. Its value is now so well established that it competes successfully with the finer varieties of imported woods. A peculiarity of the laurel is the facility with which it may be stained to imitate the finer hard woods. It is extensively used, when stained and polished, to represent Brazilian rosewood, black walnut, satin-wood, mahogany, and other woods. The imitation is so perfect that good judges have been deceived after careful scrutiny.

Rosin, turpentine, and theoline.—These products are derived from the trees of the Sierra Nevadas. The first two are procured by tapping the sugar pine and white fir trees, the quality of the spirits of turpentine being good, while the rosin (of which only one variety is made) is preferred by soap makers and others to that produced in the Carolinas. Theoline and rosin are derived from a species of fir, found at a greater elevation than the other trees named. The property of theoline for cleansing clothing and gloves is said to be remarkable, while the rosin is of the best quality. No tar or pitch is manufactured, as the trees are never cut down, and do not contain knots of pitch to admit of burning for tar or pitch. The sugar pine and white fir are to be found in almost unlimited numbers along the whole length of the Sierra Nevadas; but, so far, the making of turpentine and rosin has been limited to small districts in Butte, Yuba, and Nevada counties. The production for 1866 was: spirits of turpentine, 40,000 gallons; rosin, 14,000 boxes, of 280 pounds each; and of theoline, an inconsiderable quantity, not known.

Tan bark and teasels.—In some sections of the State, mainly in the north coast districts, a species of oak tree is found, the bark of which is most excellent for tanning purposes. The bark is said to be superior to the oak bark used in the Atlantic States, as it contains a larger percentage of tannin, the entire thickness of bark being equally valuable. The value of this bark has been demonstrated so successfully that nearly 200,000 hides are tanned yearly, which mainly find sale in California and adjacent States and Territories, and considerable quantities are exported to China, Mexico, and other countries. The supply of this bark is said to be inexhaustible. Teasels of inferior quality grow wild in many portions of the State. Although of no pecuniary value for sale, they clearly demonstrate that the French teasel of commerce could be grown successfully.

WINES AND BRANDIES.

The cultivation of the grape in California is so general and extensive that the wine interest promises, at an early day, to exceed that of any other branch of agriculture in the State. The soil and climate have proved so well suited to vine growing, that at the present time the number of vines in California probably exceeds that of all the rest of the States combined. The returns of the county assessors are so grossly inaccurate in many cases that but little reliance can be placed on them for statistical information on which to base statements. Persons largely engaged in wine-making, and possessing good opportunities for judging, estimate the total number of vines and cuttings planted up to 1866 as about 30,000,000. Of these it is estimated that some 8,000,000 to 9,000,000 are bearing vines, the fruit of which is mostly made into wine and brandy. The total wine crop of 1866 is estimated at about 3,000,000 gallons of wine, and probably 50,000 gallons of brandy, the heavy excise tax of two dollars per gallon on the latter causing a great increase in wine making, which would otherwise have found its amount seriously diminished by distillation into brandy. In previous years a large number of vine-growers made no wine, as brandy could be made readily, and at once find sale, which was not the case with wine. Planting of vineyards is going on at the rate of at least 3,000,000 cuttings per year, and the produce of wine in ten years from date promises to exceed in value that of wheat, or, in fact, all the cereals combined. The native vine, or, rather, the mission grape, was introduced by the Catholic priests when the missions were founded. It is a large blue grape, growing in large clusters, some of which have been exhibited weighing seven pounds. It is said to have been brought originally from Seville, Spain, is a vigorous grower, and bears abundantly in all parts of the State, the grapes, as a general rule, being larger in size when grown in the south coast district. Hardly an inhabited township in the valley

counties can be found where the cultivation of this variety of grape is not engaged in. The making of wine is a common occurrence with thousands of persons, who make it for private use, and in small quantities. Although San Francisco county is not a vine-growing locality, there are at least 30,000 gallons of wine made annually within its boundaries from grapes grown in other places and sent to the city for a market.

During a portion of August, and all of September and October, an average of 500 boxes of grapes, of 40 pounds each, are sold in San Francisco, at prices ranging from 1½ to 3 cents per pound, used exclusively for wine-making by Italians, Frenchmen, and other persons engaged in gardening and fishing. Parties well informed on the subject estimate that from 25,000 to 30,000 gallons of wine were made in the county of San Francisco in 1866. The cultivation of the grape for wine-making has become so general that there is hardly a county in the State that is without vineyards. A vast amount of land, hill-slopes, rugged, rocky, and unfit even for ordinary pasturage, is being planted with vines, which, so far as tried, has proved of superior quality for grapes. In the Sierra Novadas, below an elevation of 2,500 feet, there is a belt of land almost valueless for ordinary agricultural purposes that will average 25 miles wide, and between 300 and 400 miles long. The greater portion of this land will, in time, be planted in vineyards, as the wine produced is of a very superior quality. In this connection it may be proper to divide the mountain vineyard lands of the State into three sections or classes, that the peculiar properties of the soil, the climate of each, and the wine made may be better described. I name them as follows: Los Angeles district, north Coast Range district, and the Sierra Nevadas. The wines produced in these districts from the same grape vary greatly, and are as distinct in their classification as the wines of Spain and Portugal from those of France and Germany, and they in turn from the wines of Madeira and Teneriffe. In the Los Angeles district, which comprises San Diego, San Bernardino, Los Angeles, and Santa Barbara counties, the wines as a general rule possess a large percentage of alcohol. The so-called white wine of this district has very little aroma, is quite heady, and generally of a golden tint rather than white. Port, Angelica, and Muscat wines are produced in large quantities. The sweet taste of these wines is caused by the grapes being somewhat wilted or overripe when gathered, and the addition at a certain stage of making of from 10 to 12 per cent. of brandy or pure spirits to prevent complete fermentation. By the latter the grape sugar is retained, which would otherwise be changed into alcohol. These wines are great favorites in some parts of California, where the percentage of spirits is often increased by consumers adding from one-quarter to one-half of proof native brandy when drinking. In this district a considerable quantity of sherry wine is produced. The process of making it is a forced one, a high degree of temperature being required to cook or ripen the wine to the desired bouquet and flavor. The vine having been planted in this section of the State when the missions were created, in 1779, its culture is not only older, but was more extensive, until within the past four years, than in any other district. The yield of wine is at the present time much larger than in the other districts, Los Angeles county alone producing, in 1866, between 1,100,000 and 1,200,000 gallons, the number of vines being reported at 2,500,000, which is probably an underestimate. Assessors, in collecting statistics regarding agricultural products, have in many cases counted bearing vines only, which well-informed men think has been the case in Los Angeles county. The wine-growers of the Los Angeles district labor under many serious drawbacks not experienced in the other sections of the State. They are some 300 to 400 miles distant by sea, and have also considerable land transportation on their wines to the coast for shipment, their only market, aside from local consumption, being San Francisco. The freight is disproportionately heavy on the wine, while the empty casks, in the absence of suitable timber, having to be brought

from the same port, renders their cost equal to full fifteen cents per gallon delivered at the vineyard. In the early days of wine-making, when this district had a virtual monopoly of sales, the value of the wine was high enough to bear these expenses, and wine-making was an extremely profitable pursuit. Competition from the other districts, however, has reduced the price of wine to such low figures that during the last four or five years prior to the laying of the excise duty of two dollars per proof gallon on wine spirits, quite a large portion of the grape crop was distilled into brandy.

This method of marketing their grape crop was especially advantageous to small vineyard proprietors, who thereby avoided the large outlay which would be required in the construction of cellars, vats, and casks to ship wine in, and more especially the delay of from six to ten months which their crop of wine would require before it was in a fit state to transport to market. The excise duty of two dollars per gallon bore especially hard on this class of men, who had either to sell their grapes at what they might be offered to the larger wine-makers, feed them to hogs, or lose them altogether. With a low excise duty a very large amount of brandy will be made, which, as it acquires age, will improve in quality and come into serious competition with that imported from France. Under the circumstances attending grape culture in the Los Angeles district, it is probable that the larger portion of the grape crop will ultimately be made into brandy, and form the great bulk of that spirit made in the State.

Coast Range district.—In this section, which includes the whole of the Coast range of mountains and valleys, is to be found the claret and sauterne wines of the Pacific coast. The most noted locality for these styles of wines is Sonoma county, where the cultivation of the wine rivals that of Los Angeles in extent. The general percentage of alcohol in wines is lighter than in those of other districts, and the character of the wine made resembles greatly that of Bordeaux or the Rhine provinces, according as the quality of soil varies or method followed in making. The wines of this district, also, possess a better bouquet than those made elsewhere from the same variety of grape. While on this subject it is proper to state that the only grape used in Los Angeles district for wine-making is the Mission or Los Angeles grape. In the Coast Range district, and more especially in Sonoma county, there is a disposition among vineyard proprietors to introduce the culture of foreign varieties of grape for wine-making, and in some instances wine has been made from them of much improved flavor. The quantity of wine made from foreign grapes is, however, extremely small, and probably not over one per cent. in the product of 1866. The most of the foreign varieties, aside from those used solely for table purposes, have been found to be extremely shy bearers, and therefore unprofitable for wine-making. A few varieties have proved excellent, producing large crops of grapes, equalling in quantity the Mission grape, which in some localities is a large bearer. This is peculiarly the case with the Black Zinfindel, said to be a Hungarian seedling of the Black Pineaux, the true champagne grape of France. The Black Zinfindel in Sonoma valley makes a very fine red wine, resembling in looks, aroma, and taste the finest brands of claret imported. The variety is so highly esteemed that it seems probable, from the demand for cuttings for 1867, that in some sections of Sonoma county it will eventually take the place of the Mission variety as a wine grape. Probably no wine-making country has such a variety of soil, often found in limited localities, as California. In the township of Sonoma, which comprises Sonoma valley, this is particularly apparent. In this valley, which is on an average less than three miles wide by eleven miles long, is to be found every variety of soil, ranging from a chalky gravel to a bright red volcanic loam. Where the soil is chalky the wines made are generally of a lighter color, and possess a smaller percentage of alcohol, both of which increase in amount as the soil varies towards the red tint. Some idea of the extent of grape cultivation in the valley may be formed from the assessor's

returns for 1866, which give the total number of vines of two years old and over as 1,555,321. In making this estimate the assessor based his calculations on an average of 600 vines to an acre of vineyards, while the average proper should be about 900. Very few vineyards had less than 660 vines per acre, while in the majority of cases there were from 880 to 1,300 vines. This style of making up returns is reported to be very common with county assessors and their deputies. In Sonoma valley one vinecultural society has 3,200 acres of vineland, some 400 acres being in bearing. This society (the Buena Vista) made the first true sparkling wine in California, which brand has a good reputation as compared with the second-class champagne wines of France. This wine was made from the native or Mission grape, and has not as good flavor as is expected from the foreign varieties just coming into bearing. Besides the claret and sauterne varieties common to this district, efforts are now being made to produce port and sherry wines; but the probabilities are against any very large quantity being made, as there is strong competition in these wines from the Los Angeles district. Should no unforeseen causes prevent, the wine crop of this district will in ten years exceed that of any other, the planting of new vines being in excess of the other two districts combined. Its proximity to the great export market of San Francisco, with cheapness of freight and adaptability of soil for grape cultivation, plainly indicate that the wine crop within the time specified will equal, if not exceed, that of all other agricultural products in the district. The brandy made in this district, also, is freer from faults of flavor, and will in time be a favorite with consumers. During 1866 there was made at least 1,000,000 gallons of wine in the Coast Range district, and, with a good crop of grapes, the coming year will witness an increase of full fifty per cent. in the product.

The Sierra Nevada district.—This district possesses more land especially suitable for grape cultivation than any other. The range of mountains from Shasta to Santa Barbara, say 25 miles wide and 350 miles long, has no superior, if any equal, for grape cultivation. The quality of the soil varies materially, but its predominating character is a red volcanic debris, which produces abundant crops of grapes. The climate is also free from those alternations of heat and cold during summer which prevail in the Coast Range district, often damaging seriously the more tender varieties of grapes. In the Sierra Nevadas the winters are longer, and, as a consequence, the spring time freer from injurious frosts. The climate of the foot-hills is also drier, and during the summer maintains an equable temperature, which to a high degree improves the flavor and matures the grape. This, combined with the absence of rains from April to November, gives the wine-grower great advantages, which to a large extent offset the drawback of distance from an export market. With the construction of railroads through this section of the State the disadvantages of long transportation will in a measure be overcome, and the soil and climate attract wine-growers, while the quality of the wines will command the attention and favor of consumers. The wines made in the Sierra Nevadas, as a class, resemble those of Madeira and Teneriffe. They contain a larger percentage of alcohol than any others, and have a peculiar delicacy of flavor not found in the wines of other districts. So far as known it is almost impossible to make a claret or sauterne wine, although considerable wine made resembles the former, but has a larger amount of tannin and alcohol in it. Port, sherry, and some varieties of sweet wines are made, which find a ready sale in the vicinity of the vineyards. Wine-growers in this district vary greatly in their mode and treatment of wine, thus affecting the flavor of the wine produced, it being difficult to find two wines alike. A commendable feature in this district is the disposition of growers to propagate foreign grapes, with a view to ascertain the best varieties for wine-making. In this particular the district is far ahead of any other, and the result has been the making of superior

qualities of wines, which command, with connoisseurs, prices equal to those paid for the best imported varieties. Among the wine-growers who propagate foreign grapes, B. N. Bugbey, of Natoma vineyard, El Dorado county, has been more prominent than any other, his experiments having been extensive, and made regardless of expense. His vineyard at Natoma valley, consisting of 56 acres of vines, contained 72 varieties of grapes, among which were to be found the rarest wine grapes of Europe. In 1865 this gentleman made 19 varieties of wine from as many different grapes. Of some of these the quantity did not exceed five gallons, but he was determined to test the quality of the different varieties, with a view of selecting the best, and reducing the number to from six to eight kinds. He succeeded in making excellent wines from the Los Angeles, Catalzac, White Pineaux, White Malaga, Red Traminer, Verdelho, White Riesling, Black Zenfindel, Black Prince, Flame-colored Tokay, Royal Muscadine, Fiher Zagos, White Tokay, Golden Charsalis, and White Nice grapes. The Black Hamburg, Muscat of Alexandria, Catawba, and Isabella, made fair wines, but considerably inferior to the others. Out of the entire number Mr. Bugbey selected five varieties to be cultivated in future, valuing them in the order named, the first being the best, viz: Black Zinfindel, Red Traminer, White Malaga, Verdelho, and Los Angeles. These varieties were valued in a monetary view, the Verdelho making the best wine, while the Black Zinfindel produced the largest quantity of grapes. The results of these trials has greatly stimulated the propagation of foreign grapes in this district, and many years will not elapse before wines from foreign grapes grown in California will be seeking market in the cities of the Atlantic coast.

GENERAL REMARKS.

In speaking of the wines of the various districts I have given the general characteristics of the bulk made. In every section there are wines which resemble no foreign varieties known. As a rule wine-makers vary their wines by the time of picking, pressing, manner of fermenting, and treatment while curing. As a consequence there are scarcely two makes of wine of exactly the same flavor to be found. Wine-makers have generally gained knowledge of their business through personal experiments only, the European mode of wine-making not being adapted to the grape or climate. The success that has so far attended their efforts shows conclusively that in time the wines of California will not only supply the home demand, but come in vigorous competition with the wines of Europe in many foreign markets. From present appearances the wine interest of the Pacific coast will, by the close of the present century, outrank in importance all the other agricultural products combined.

ADVANTAGES AND DRAWBACKS OF AGRICULTURE.

It is proper, before closing this article, to enumerate the many advantages our farmers have over those of other States, and the peculiar drawbacks incidental to California. In addition to the great superiority of climate, the vegetation in California is almost entirely free from the ravages of insect life, often so disastrous in the other States. With the exception of occasional irruptions of what are termed the army worm and grasshoppers, there is no insect life to injure vegetation. The ravages of those named are seldom of any great extent, the sections of country where they prevail at any time being limited. One cause for the comparative freedom from insects is the dryness of the summer season, and the immense quantities of small insect-feeding birds which are to be found all through the country. In many parts of the State, however, considerable damage is done to the grain crops by ground squirrels and gophers, which

exist in great numbers. A little attention has already destroyed them in some sections, and the same care exercised by farmers generally would rid them of these pests. Another drawback is the high cost of transportation of produce to market, and the limited character of the home consumption compared with the crops raised. These difficulties, however, will vanish with the increase of population, which may reasonably be expected soon, and the construction of a network of railroads now projected and being constructed through many portions of the State.

THE GREAT WANTS OF CALIFORNIA.

The greatest want of the State, at the present time, is a large immigration. During the last ten years there has been comparatively little increase in the population. This state of things has been brought about by a variety of causes, which have prevented a flow of immigration on the one hand, and on the other drained the State of a large number of her best people. The Indian troubles on the plains, high price of ocean travel, the late rebellion, and the efforts of immigration agents of the so-called western States, at the Atlantic ports and Europe, have diverted the tide of population, which otherwise would have sought this State. The discovery of rich mining regions in adjacent States and Territories has drawn from California many of her best citizens, whose places have hardly been filled by immigration and natural increase up to the present time. California has contributed largely to the peopling of British Columbia, Oregon, Idaho, Nevada, Arizona, and Montana. The aggregate of these drafts upon the population is very large, and not properly estimated or known to the mass of her people. They only see that the State has not increased in population, and that immigration is needed to restore the prosperity of other days. Fortunately the vast increase of home manufactures has given employment to a large number of people, and kept the money which was formerly sent out of the country to pay for these articles when imported. By this means, in connection with abundant grain and wool crops, a vast drain on the finances of our people has been avoided, which otherwise would have caused a paralysis or stagnation of business that would have been most disastrous in its effects. California only needs immigration to make her rank as one of the wealthiest States of the Union. She has room for five times her present population, who could be profitably engaged in developing her unrivalled resources of agricultural and mineral wealth. She needs more varied crops, more prudence in living, and industry among her people. Under the present system of farming our agricultural population are idle for nearly half the year, waiting either until nature prepares the land for ploughing, or the crops mature for reaping. As a rule there is no intermediate employment to occupy their time, or to profit their families. Nine-tenths, or rather nineteen-twentieths of our grain-growers do not raise a potato or vegetable of any kind for their family or stock. The general excuse is it will not pay them to do so, and, as a consequence, they purchase of others at high prices. It will hardly seem credible to the farmers of the Atlantic States that their brethren in California, while engaged in grain-raising, purchase their butter instead of making it themselves, yet this was a common habit a few years since. In 1860 the writer visited a farm in Sutter county, about twelve miles from Marysville. The proprietor had 170 head of fine American cows, which came daily to the barnyard; yet there was no milk for tea or coffee, and States' butter was bought for family use. This was not an exception, but was the general rule in that section of country. California needs prudent, economical, and enterprising immigration. Persons must not come with the expectation that fortune will smile on them without their personal efforts to succeed. To the honest, energetic, and industrious there are opportunities to acquire wealth, either by farming, mining, or

mechanics, that cannot be found in the other States. With the same energy, industry, and prudence that are exercised by the population of the middle States, California would, when properly peopled, outstrip in the value of her annual crops the States of New York, Pennsylvania, Ohio, and Indiana combined. She has the area of soil, fertility, and climate that, if taken advantage of, will make the statement above no vain boast, but a reality. To those who are seeking homes in the far west, with intent to gain a competence through industrious labor, I recommend California as presenting advantages not to be found elsewhere. To the idle and shiftless, it is the worst place to which they can come.

METEOROLOGY OF 1866.

BY A. B. GROSH, DEPARTMENT OF AGRICULTURE.

Compiled from the monthly reports made to the Smithsonian Institution, through this department. The observations, with slight or occasional exceptions, were made daily at the hours of 7 a. m. and 2 and 9 p. m.]

Stations in States and Territories.	JANUARY.						FEBRUARY.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MAINE.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
teuben	20	44	7	—20	16.5	2.61	23, 24	46	7	—13	22.7	6.88
ee	1, 20	36	7	—28	12.3	2.40	24	54	7	—19	21.8	8.23
elfast	......	......	7	—24	......	......	......	......	......	......	......	......
Vest Waterville	1, 18	40	7	—23	15.0	2.39	23, 24	48	7	—14	21.2	6.25
ardiner	1	40	7	—18	14.1	1.63	24	47	7	—14	21.4	5.24
isbon	......	......	7	—18	......	2.05	......	......	......	......	......	......
Vebster	1	39	7, 8	—16	15.1	......	23	46	3, 7	—10	23.1	......
tandish	1	40	7	—17	17.3	1.48	23	51	7	— 8	22.7	5.04
ornish	10	38	8	—18	16.9	1.45	24	48	16	— 7	21.7	5.70
ornishville	1, 10	37	7	—16	17.3	2.10	24	49	16	— 8	22.3	5.12
Averages	......	......	......	......	15.6	2.01	......	......	......	......	22.1	6.07
N. HAMPSHIRE.												
tratford	20	39	7	—33	10.5	3.00	23, 24	51	16	—15	18.7	3.01
helburne	1	42	8	—18	17.2	2.40	24	50	17	—18	......	......
orth Barnstead	1, 10	40	8	—15	20.5	1.00	24	60	5, 16	— 2	25.5	2.28
oncord	......	......	......	......	......	......	24	55	5	— 5	23.0	......
laremont	1, 18	40	8	—20	17.1	1.60	24	53	3	— 6	23.8	5.45
Averages	......	......	......	......	16.3	2.00	......	......	......	......	22.8	3.58
VERMONT.												
unenburg	18, 20	37	7	—31	14.5	1.55	24	57	7	—20	20.4	3.35
raftsbury	20	35	8	—25	11.7	1.96	23	54	16	—16	18.3	3.22
andolph	1	40	7	—20	17.9	1.72	24	49	16	—19	21.8	4.02
iddlebury	20	44	7	—21	15.3	1.20	24	48	16	— 8	21.6	4.22
randon	20	44	7	—20	18.1	0.71	23	52	16	— 8	23.2	5.34
Averages	......	......	......	......	15.5	1.43	......	......	......	......	21.1	4.03
MASSACHUSETTS.												
awrence	......	......	......	......	......	......	24	58	7	— 2	27.2	4.63
opsfield	1	46	8	—15	26.7	2.02	24	61	7	9	33.5	3.77
eorgetown	20	43	8	—16	21.0	......	24	57	5, 7	— 2	26.5	......
ewbury	20	45	8	—16	21.5	......	24	58	5	— 2	26.4	......
ambridge	18	43	8	—18	22.0	1.31	24	60	7	— 2	27.9	......
orth Billerica	......	......	......	......	......	......	24	60	3	— 4	28.4	......
ew Bedford	20	49	8	—12	25.7	2.17	23	53	7	1	30.5	4.37
orcester	19	44	8	—15	24.0	2.56	24	57	7	0	27.0	5.27
endon	13	52	8	—17	26.3	7.00	24	56	7	— 4	28.6	3.90
mherst	18	40	8	—15	21.9	1.36	24	55	7	— 3	26.2	4.62
pringfield	13	48	8	—21	22.9	1.52	24	55	7	— 3	27.1	4.86
estfield	13	46	8	—16	24.9	1.74	23, 24	55	7	— 2	29.5	4.53
ichmond	20	46	8	—18	19.6	3.25	23, 24	54	16	— 4	......	......
Villiams College	20	45	8	—18	19.0	1.01	24	55	16	—15	24.9	1.78
Averages	......	......	......	......	23.0	2.39	......	......	......	......	28.0	4.19

Meteorology of 1866—Continued.

Stations in States and Territories.	JANUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	FEBRUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
RHODE ISLAND.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Newport	18, 19	46	8	— 6	26.6	3.37	23, 24	53	7	5	31.[illegible]	[illegible]
CONNECTICUT.												
Pomfret	19, 20	44	8	—19	22.1	0.73	12	57	7	— 3	26.7	5.03
Columbia	13	52	8	—20	25.6	1.40	11, 23, 24	56	7	5	31.1	......
Middletown	13	50	8	—15	25.0	1.61	23	58	7	0	28.7	5.11
Colebrook	13	48	8	—25	18.7	......	24	55	7	— 8	23.5	......
Groton	20	50	8	—15	......	......	23	55	7	0	31.6	4.86
Averages	......	......	......	......	22.9	1.25	......	......	......	......	28.3	5.00
NEW YORK.												
Moriches	20	49	8	—10	30.0	2.59	23	58	16, 17	11	34.3	5.99
South Hartford	20	46	8	—19	19.0	1.18	23	56	16	—10	25.6	4.74
Albany	......	......	......	......	......	......	24	58	5, 7, 16	8	32.0	2.56
Fishkill	20	46	8	—13	21.3	0.99	24	54	7	4	28.5	5.36
Garrison's	18, 20	43	8	—16	22.0	2.35	24	52	7	1	27.7	3.73
Throg's Neck	13	43	8	—14	24.7	1.57	23	56	16	4	28.9	4.8[illegible]
White Plains	13	46	8	—20	28.2	......	......	......	......	......	......	......
Deaf and Dumb In.	13, 20	49	8	—13	29.6	2.56	11	59	16	5	34.3	11.00
Columbia College	20	45	8	—14	25.8	2.83	23	52	16	6	29.6	5.05
Flatbush	......	......	......	......	......	......	23	52	16	5	29.9	2.17
Newburgh	13	52	8	—15	23.7	1.53	22	51	7	0	27.8	5.03
Gouverneur	20	48	7	—28	11.3	1.55	23	51	16	—22	20.9	2.79
North Hammond	20	40	6, 7	—28	14.2	5.32	10, 18, 23	48	16	—14	22.7	5.6[illegible]
South Trenton	20	42	8	—22	......	2.85	22, 24	50	6	— 2	22.5	5.75
Oneida	20	51	8	—20	19.6	1.80	22, 23	48	5	— 6	25.4	5.36
Theresa	1	38	15	—23	13.6	2.25	23	51	5	—17	20.0	2.[illegible]
Depauville	20	54	7	—16	16.3	3.32	23	49	16	— 8	21.9	3.[illegible]
Oswego	20	50	8	— 8	21.1	1.14	22	48	16, 17	1	24.6	2.[illegible]
Palermo	20	46	8	—20	18.5	1.56	23	48	5, 6	— 9	20.8	7.30
Skaneateles	......	......	8	—19	......	......	24	50	16	— 2	33.6	......
Baldwinsville	20	58	7, 8	—18	19.0	0.70	24	48	16	1	29.3	......
Nichols	20	50	7	—18	22.6	......	23	57	16	— 2	27.2	......
Genesee	20	48	8	—12	22.1	0.82	22	53	16	0	25.5	1.77
Rochester	20	50	7, 8, 9	— 3	22.7	1.48	22	53	16	2	26.0	2.30
Rochester Univer'ty	20	51	9	— 4	21.7	1.48	22, 23	53	16	— 3	25.6	2.39
Little Genesee	......	......	......	......	......	......	23	58	16	—10	24.4	......
Buffalo	19	55	7	— 6	22.3	1.46	23	54	16	— 5	25.5	2.55
Jamestown	19	56	8	—17	19.8	1.10	22, 28	60	16	—16	25.8	4.66
Averages	......	......	......	......	21.3	1.93	......	......	......	......	26.7	4.32
NEW JERSEY.												
Paterson	13	48	8	—14	26.1	1.33	24	55	16	3	29.6	5.67
Newark	13	46	8	—13	25.8	1.74	14	59	16	5	30.2	5.0[illegible]
New Brunswick	13	48	8	—12	26.1	1.65	23, 24	62	16	3	30.6	4.76
Trenton	20	49	8	—12	......	3.02	24	58	16	8	33.8	6.2[illegible]
Burlington	13	50	8	— 8	27.7	2.00	24	64	16	4	32.9	5.20
Moorestown	13	52	8	—12	27.3	2.68	23	64	16	4	31.9	5.1[illegible]
Mount Holly	20	56	8	— 9	28.8	......	24	64	16	8	33.3	......
Seaville	......	......	......	......	......	......	12	54	5	10	35.3	8.90
Haddonfield	20	47	8	—12	27.4	2.08	11, 24	61	16	3	31.3	4.0[illegible]
Greenwich	19, 20	52	8	— 9	29.5	2.29	23	58	16	6	33.4	4.[illegible]
Averages	......	......	......	......	27.3	2.80	......	......	......	......	32.2	5.[illegible]
PENNSYLVANIA.												
Nyces	19	62	8	—23	20.2	1.26	23	49	7	—10	23.0	4.85
Fallsington	13	50	8	— 9	30.0	2.20	24	62	16	7	33.3	5.00
Philadelphia	13	52	8	— 9	30.3	2.88	24	60	16	8	35.2	6.64

Meteorology of 1866—Continued.

Stations in States and Territories.	JANUARY.						FEBRUARY.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
PENNSYLVANIA—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Germantown	13,18,20	50	8	—13	27.6	......	23	59	16	2	31.8	......
Horsham	3	52	8	—12	27.0	1.30	23	59	16	3	30.8	5.10
Dyberry	20	44	8	—22	17.5	......	23	59	7	—12	22.7	......
Nazareth	19	53	8	—11	26.8	......	11	56	16	0	29.8	......
North Whitehall	18	46	8	—13	25.6	......	24	50	16	2	29.0	......
Parkesville	20	51	8	—10	26.8	2.09	23	57	16	3	30.8	6.14
Oley	......	......	......	......	......	......	28	61	16	1	33.8	......
Ephrata	13	68	8, 9	— 9	28.2	3.87	23	68	5	4	31.7	4.57
Silver Spring	13	52	8	— 6	28.1	......	23	56	16	4	30.9	......
Mount Joy	23	60	8	— 5	30.8	2.00	23	58	16	5	32.6	1.30
Harrisburg	13	47	8	— 2	28.4	2.35	23	55	16	6	31.9	4.11
Lewisburg	13	48	8	— 8	23.3	1.91	23	53	7	5	26.9	2.74
Tioga	20	56	8	—24	23.6	......	23	62	16	— 8	27.1	2.10
Fleming	13	41	8	— 8	24.6	0.55	23	56	5	— 6	26.6	2.15
Pennsville	19	60	8	—12	22.6	2.55	28	55	17	— 8	24.4	3.30
Connellsville	19	67	8	—12	26.8	......	23	62	16	— 9	30.3	......
Newcastle	19	60	8	— 5	26.6	......	23	58	16	— 7	28.7	......
Canonsburg	19	58	8	— 7	24.9	1.76	22	58	16	—10	27.5	2.54
Averages	......	......	......	......	26.0	2.06	......	......	......	......	29.5	3.89
MARYLAND.												
Woodlawn	13	54	8	— 7	29.8	2.61	23	58	16	4	33.2	5.86
Catonsville	13	52	8	— 7	27.3	......	11	56	16	0	30.6	......
Annapolis	13	54	8	— 5	31.7	2.19	23	56	16	4	34.2	5.43
St. Inigoes	13	61	8	— 8	32.9	2.53	11	65	16	3	37.1	4.26
Frederick	13	53	8	— 7	29.3	1.75	23	60	16	1	30.1	3.25
Averages	......	......	......	......	30.2	2.27	......	......	......	......	33.0	4.70
VIRGINIA.												
Wytheville	19	63	5	8	33.2	......	10	62	16	— 3	34.1	......
WEST VIRGINIA.												
Cabell C. H	19	69	8	3	34.3	1.90	23, 28	64	16	— 2	34.2	1.10
NORTH CAROLINA.												
Wilson	......	......	......	......	......	......	24	74	16	10	44.2	2.37
GEORGIA.												
Atlanta	19, 30	71	9	15	42.0	3.98	23	64	16	4	42.1	5.18
TEXAS.												
Austin	19	79	20	21	53.3	0.38	2	84	15	19	50.2	1.18
MISSISSIPPI.												
Natchez	19	76	5	22	48.0	3.90	23, 28	70	15	14	47.4	10.70
ARKANSAS.												
Helena	19	78	21	20	45.9	2.07	28	73	15	7	44.2	6.47
TENNESSEE.												
Clarksville	19	73	21	12	38.1	4.37	27	66	15	0	37.6	4.14

Meteorology of 1866—Continued.

Stations in States and Territories.	January. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	February. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
KENTUCKY.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Louisville	19	70	8, 9	5	34.5	4.67	23	67	15, 16	— 3	36.3	[illegible]
Chilesburg	19	68	9	2	34.0	4.68	27, 28	62	16	— 4	34.9	[illegible]
Danville	19	73	8, 9, 21	8	36.0	5.34	28	70	15, 16	— 1	36.2	[illegible]
London	19	66	9	6	33.7	......	28	66	16	— 3	33.8	......
Averages	......	......	......	......	34.6	4.90	......	......	......	......	35.3	[illegible]
OHIO.												
Austinburg	19	54	9	—10	21.0	0.35	23	52	16	—14	23.0	......
Saybrook	19	58	9	— 8	23.2	1.50	23	56	16	—13	24.9	......
New Lisbon	19	62	8	— 2	27.5	1.33	22, 23	68	16	— 8	29.1	[illegible]
East Fairfield	19	58	8	— 3	25.5	1.90	23	54	16	— 8	27.4	[illegible]
Steubenville	19	64	8	— 6	29.5	1.93	22	56	16	— 3	32.2	......
Welshfield	19	60	7	— 4	22.8	3.34	28	56	16	—12	25.0	3.49
Milnersville	19	66	8	— 3	26.2	2.05	23	61	16	—10	29.0	1.96
East Cleveland	19	61	9	0	26.7	1.99	28	59	16	—11	27.8	2.30
Wooster	19	60	8	— 2	25.2	0.47	22	58	16	—10	26.3	......
Gallipolis	19	67	8	1	31.9	4.14	22, 28	61	16	— 2	33.2	2.57
Kelley's Island	19	51	8	3	25.4	1.81	22	51	16	—13	26.1	1.66
Norwalk	19	60	9	3	25.2	1.73	28	59	16	—13	26.5	2.77
Westerville	19	61	8	— 2	27.0	2.73	28	58	16	— 9	27.0	......
Kingston	19	64	8	1	29.4	3.42	22	64	16	— 7	30.7	2.07
Toledo	19	57	8	— 1	24.7	1.75	23	56	16	—16	25.5	2.81
Marion	19	59	8	— 1	25.0	2.72	28	58	16	—14	25.2	2.22
Urbana University	19	61	8	— 2	25.8	3.39	22, 28	58	16	—12	26.3	2.25
Hillsboro'	19	63	8	— 3	28.2	4.35	23	58	16	— 8	29.3	2.33
Ripley	19	68	8	3	34.3	4.81	22	64	16	— 6	33.6	1.95
Bethel	19	66	8	0	28.5	3.75	22, 23	62	16	— 8	30.4	1.97
Cincinnati	19	68	8	2	31.1	2.74	23, 28	62	15	— 6	32.0	1.96
Farm School	19	64	8	2	29.0	3.48	23, 27	58	16	— 7	28.8	0.68
Averages	......	......	......	......	27.0	2.53	......	......	......	......	28.2	2.04
MICHIGAN.												
Monroe City	19	50	8	— 8	24.0	0.40	22	53	16	— 8	26.8	1.90
State Ag. College	19	47	9	— 7	21.2	2.08	22	54	16	—15	22.7	[illegible]
Homestead	29	39	8	—16	18.6	......	28	47	26	— 9	18.5	......
Holland	12	43	9	— 9	24.0	3.11	28	54	15	2	25.8	[illegible]
Averages	......	......	......	......	22.0	1.86	......	......	......	......	23.5	[illegible]
INDIANA.												
Balbec	19	62	9	— 2	24.4	......	22	52	16	—27	20.3	......
Aurora	19	67	8	0	......	3.75	22, 23	61	16	—10	31.3	[illegible]
Vevay	19	69	9	2	32.3	4.06	27	70	16	— 7	33.6	[illegible]
Richmond	19	61	8	1	25.9	3.20	23, 28	55	16	—20	25.3	[illegible]
Albion	19	60	8	— 4	24.0	......	......	......	......	......	......	......
Spiceland	19	61	8	2	27.3	3.10	28	60	16	—21	27.0	2.50
Columbia City	19	62	4, 5, 9	— 4	22.5	1.29	28	60	16	—23	25.7	2.05
Indianapolis	19	60	9	2	28.1	......	28	62	16	—15	27.9	......
New Harmony	19	68	20	10	35.5	2.64	28	65	16	— 2	34.2	[illegible]
Averages	......	......	......	......	27.5	3.01	......	......	......	......	28.2	2.03
ILLINOIS.												
Chicago	12	38	20	—10	18.5	......	28	46	16	—20	17.9	......
Evanston	12	45	20	— 8	23.3	2.00	......	......	......	......	......	......
Marengo	12	41	20	— 1	19.5	0.83	28	52	15	—17	20.7	......
Riley	12	39	20	—13	18.7	2.11	28	53	15	—20	19.3	[illegible]
Golconda	19	69	20	10	38.3	......	28	70	15	— 8	38.7	1.20
Aurora	12	42	20	—10	20.3	1.97	28	55	15	—20	21.5	1.42
Sandwich	12	41	20	—11	18.6	2.10	28	53	16	—23	19.6	1.60
Ottawa	12	45	20	—12	21.9	2.85	28	57	15	—22	20.9	2.49
Winnebago	12	38	20	—14	16.7	2.49	28	53	15	—21	17.9	0.98

Meteorology of 1866—Continued.

Stations in States and Territories.	JANUARY.						FEBRUARY.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
ILLINOIS—Cont'd.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Wynnet	6	50	20	—10	21.7	2.03	28	57	15	—19	21.9	1.61
Tiskilwa	12	44	20	— 7	23.3	......	28	54	16	—17	22.8	......
Elmira	6, 31	45	20	—13	22.3	2.55	28	62	15	—22	23.3	1.05
Hennepin	......	......	......	......	......	......	28	60	15	—18	23.0	......
Peoria	12	46	20	— 4	25.1	3.21	28	59	15	—13	25.0	1.10
Springfield	6, 12	46	20	— 1	26.0	......	27	60	15	—12	26.6	......
Loami	6	47	20	— 5	25.2	3.35	27, 28	62	15	—16	26.7	1.75
Dubois	19	68	20	— 3	30.5	2.30	28	63	15	— 6	29.2	1.30
Galesburg	12	45	20	—10	21.3	2.75	28	55	15	—17	20.4	0.98
Manchester	6	50	20	— 2	27.5	3.75	28	63	15	—14	27.6	4.03
Mount Sterling	6	53	20	— 9	25.8	......	27, 28	62	15	—18	26.2	2.11
Andalusia	12	45	20	— 8	22.6	1.68	28	58	15	—14	19.6	......
Augusta	29	55	20	— 9	25.6	3.52	28	65	15	—17	26.7	1.43
Averages	......	......	......	......	23.5	2.47	......	......	......	......	23.6	1.60
WISCONSIN.												
Manitowoc	10	44	20	—12	19.5	2.63	28	49	15	—11	18.1	1.12
Milwaukee	12	43	20	— 8	20.8	2.21	28	54	16	—15	21.2	0.65
Ripon	10	46	21	—11	17.4	......	28	54	15	—22	17.9	......
Delavan	12	38	20	—12	17.5	1.86	28	49	15	—19	17.5	1.55
Waupacca	28	42	20	—13	16.9	......	28	50	15	—18	17.2	0.80
Weyauwega	28	45	20	—10	23.9	3.72	28	58	15	— 5	23.3	0.65
Embarrass	28	40	21	—18	16.4	4.00	28	56	15	—25	15.7	1.12
Rocky Run	28	42	20	—14	17.2	3.19	28	47	15	—20	16.7	0.94
Beloit	12	40	20	—13	18.0	1.10	28	48	15	—20	17.3	0.70
Baraboo	28	44	20	— 7	21.2	6.97	28	53	15	—12	21.4	2.25
Plymouth	28	41	20, 21	—15	16.5	2.20	28	53	15, 25	—20	15.0	1.90
Odanah	......	......	......	......	......	......	9	44	15	—16	13.3	......
Averages	......	......	......	......	18.6	3.10	......	......	......	......	17.9	1.17
MINNESOTA.												
Beaver Bay	29	39	4	—18	13.4	2.70	9	48	15	—29	9.0	0.00
Afton	28	40	20	—20	10.0	......	28	44	15	—28	9.5	......
Saint Paul	28	37	20	—20	10.4	2.00	28	39	15	—29	8.6	0.30
Minneapolis	28	41	20	—21	8.2	2.05	21	40	15	—31	6.8	1.88
Forest City	10, 28	42	20	—23	16.4	......	27	49	15	—33	11.1	......
Sibley	29	41	4	—27	9.8	3.50	27	43	15	—37	8.5	......
New Ulm	10, 28, 29	38	20	—18	12.4	1.27	21, 27, 28	39	15	—20	11.4	0.40
Averages	......	......	......	......	11.5	2.30	......	......	......	......	9.3	0.65
IOWA.												
Clinton	12, 28, 29	42	4	— 5	19.8	2.80	28	54	15	—24	20.6	3.00
Lyons	13, 27, 29	36	16	0	19.5	2.78	28	47	15	—22	17.7	0.66
Davenport	29	38	20	—10	18.1	3.39	28	52	15	—17	19.7	1.21
Dubuque	12	39	20	—13	19.4	3.29	28	53	15	—20	18.8	1.28
Muscatine	10	46	20	—11	19.3	4.16	28	54	15	—21	17.0	0.58
Fort Madison	6, 29	45	20	—10	23.1	4.28	28	55	15	—20	27.1	3.05
Monticello	29, 31	36	20	—18	15.3	3.77	28	53	15	—26	13.1	1.02
Guttenberg	12, 28	35	20	—14	15.6	......	28	45	15	—23	14.7	1.39
Ceres	28	42	20	—18	16.3	......	28	49	15	—24	15.1	......
Manchester	12	40	20	—15	14.6	2.64	28	44	15	—24	10.6	......
Mount Vernon	29	41	20	—13	18.4	......	28	59	15	—20	18.6	......
Iowa City	6	47	20	—14	20.7	4.77	28	55	15	—20	19.6	1.35
Independence	29	40	20	—18	13.5	5.70	28	52	15	—30	13.5	3.10
Waterloo	29	42	20	— 8	15.1	......	28	50	15	—19	17.0	......
Iowa Falls	29	44	17	— 8	16.9	......	21, 28	42	15	—21	18.3	1.49
Des Moines	10, 11	46	20	—11	19.2	......	27, 28	64	15	—22	22.0	0.63
Clarinda	......	......	......	......	......	......	27, 28	62	14	—17	24.6	......
Averages	......	......	......	......	17.8	3.76	......	......	......	......	18.1	1.56

Meteorology of 1866—Continued.

Stations in States and Territories.	JANUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	FEBRUARY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MISSOURI.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
St. Louis	12, 29	55	20	1	31.8	4.16	27	68	15	—7	32.6	[illegible]
St. Louis Univer'ty.	12	57	20	4	33.7	3.88	27	68	15	—5	33.8	[illegible]
Athens	29, 31	50	20	—8	30.8	2.86	27	62	15	—14	29.2	[illegible]
Canton	29	52	20	—10	25.1	3.45	27	60	15	—20	24.0	[illegible]
Harrisonville	6, 29	52	20	—8	29.9	1.25	27	64	15	—8	32.0	[illegible]
Easton	6	50	20	—14	25.9	3.34	27	64	15	—21	29.6	[illegible]
Averages	......	......	......	......	29.5	3.16	......	......	......	......	30.2	[illegible]
KANSAS.												
Leavenworth	29	53	20	—12	28.4	4.51	27	68	15	—16	28.0	[illegible]
Olatha	29	54	20	—12	26.5	2.70	27	66	15	—14	29.3	[illegible]
Atchison	11	50	20	—12	24.1	......	27	62	15	—17	26.4	......
Fort Riley	11	55	20	—10	29.4	1.70	27, 28	70	13, 15	—7	33.2	......
Council Grove	11	58	20	—5	30.2	1.00	27	70	15	—6	34.1	......
Averages	......	......	......	......	27.7	2.48	......	......	......	......	30.2	[illegible]
NEBRASKA.												
Elkhorn	11, 28, 31	45	20	—14	19.8	......	28	62	15	—20	25.8	......
Bellevue	29	46	20	—11	21.3	2.05	28	65	15	—13	24.8	[illegible]
Glendale	......	......	......	......	......	......	28	68	15	—32	22.8	[illegible]
Averages	......	......	......	......	20.6	2.05	......	......	......	......	24.5	[illegible]
UTAH TERRITORY.												
Great Salt Lake City	24	.45	15	2	26.6	1.83	7, 21, 28	50	17	—3	33.0	[illegible]
CALIFORNIA.												
San Francisco	25	60	10	37	47.1	12.69	25	62	18, 22, 23	41	50.6	[illegible]
Sacramento	5, 24	60	3, 10, 19	33	46.4	7.70	26	66	23	43	53.5	[illegible]
Monterey	5, 23	65	10	34	51.2	6.07	25	71	17, 18	42	54.8	[illegible]
Meadow Valley	27, 30	50	14	0	34.4	17.35	23, 25	64	15	22	43.0	[illegible]
Averages	......	......	......	......	44.8	10.95	......	......	......	......	50.5	[illegible]
MONTANA TER'Y.												
Helena	24	48	19	—34	14.1	3.95	25	51	13	—18	21.5	[illegible]
WASHINGTON TER.												
Neeah Bay	......	......	......	......	......	......	26	50	12, 13, 14	27	37.7	[illegible]

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MAINE.												
Steuben	15	44	11	7	28.6	6.63	19	71	17	31	42.9	[illegible]
Lee	28	45	18	2	29.1	7.52	23	64	11	20	43.3	[illegible]
West Waterville	28	47	18	8	28.1	5.50	22	69	8, 9	30	45.2	[illegible]
Gardiner	15, 16, 17, 28	43	8, 18	10	28.4	5.47	19, 22	70	9	27	44.7	[illegible]
Webster	15	47	11, 18	8	27.7	......	19	73	9, 10	30	44.4	......
Standish	15, 31	48	8, 18	8	28.9	3.43	21	82	12	28	46.1	[illegible]
Cornish	15	58	18	4	27.3	5.30	21	77	10	28	44.8	[illegible]
Cornishville	15	59	18	5	27.5	4.58	21	77	9	30	42.6	[illegible]
Averages	......	......	......	......	28.2	5.49	......	......	......	......	44.3	[illegible]

Meteorology of 1866—Continued.

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
NEW HAMPSHIRE.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Stratford	15, 16	43	18, 20	— 2	23.5	3.29	21	69	10	21	41.0	2.12
Shelburne	15	54	20	3	24.9	1.04	21	78	18	29	46.4	......
North Barnstead	15	62	8	10	30.0	3.25	21	78	9	32	46.8	1.32
Concord	15	62	8	10	31.8	......	21	81	8, 9	28	48.6	......
Claremont	15	57	18	6	30.0	3.07	21	80	10	26	46.9	2.00
Averages	......	......	......	......	28.0	2.66	......	......	......	......	45.9	1.81
VERMONT.												
Lunenburg	15, 24	48	18	0	27.5	1.40	18	65	28	20	38.0	2.50
Craftsbury	3	42	18	0	22.6	2.33	18	69	30	27	41.1	1.95
Randolph	15	48	18	6	27.4	0.58	21	72	10	21	44.8	1.78
Middlebury	14	47	18	4	27.7	1.82	21	76	10	28	46.9	1.78
Brandon	3	52	18	10	29.2	1.65	21	78	3	27	47.3	0.86
Barnet	......	......	......	......	......	......	17	76	3	25	46.0	2.06
Averages	......	......	......	......	26.9	1.56	......	......	......	......	44.0	1.82
MASSACHUSETTS.												
Lawrence	15	69	10	15	22.3	3.70	21	75	8, 9, 11	32	46.6	1.10
Topsfield	15	70	8, 11, 18	20	36.2	3.81	21	81	8, 9	35	50.3	1.49
Georgetown	15	72	18	10	31.5	......	21	83	17	31	47.7	......
Newbury	15	70	8, 18	10	32.4	......	21	85	8, 9, 10	32	47.7	......
North Billerica	15	72	11	8	33.6	......	21	80	9, 10	30	49.0	......
New Bedford	13	59	5	11	33.0	3.55	22	72	9	33	46.8	1.95
Worcester	13	67	18	10	32.3	3.18	19, 22	76	8	34	49.3	2.09
Mendon	13	67	18	12	31.2	2.70	16	78	8, 9, 18	32	47.2	1.95
Amherst	15	56	18	12	31.6	3.16	21	84	8, 10	30	48.6	2.03
Springfield	13	64	18	10	25.8	2.93	21	85	10	25	48.4	2.23
Westfield	15	60	18	13	32.0	3.09	21	82	8	31	48.4	2.25
Richmond	15	58	18	8	29.2	4.36	19, 21	80	1	24	46.3	4.02
Williams College	15	62	18	8	29.4	1.24	21	80	9	24	46.2	0.75
Averages	......	......	......	......	30.8	3.17	......	......	......	......	47.6	2.00
RHODE ISLAND.												
Newport	15	53	18	14	34.3	5.11	22	68	9	34	47.1	1.74
CONNECTICUT.												
Pomfret	13	67	18	10	30.5	3.33	21	80	8	30	45.2	3.47
Columbia	13	65	18, 25, 26	16	34.3	......	22	79	2, 8	34	50.2	......
Middletown	15	65	18	12	......	2.60	22	83	10	30	50.7	2.90
Colebrook	15	64	18	2	28.6	......	21	81	8, 11	25	46.7	......
Groton	13	60	10	14	34.5	4.25	22	70	8	32	48.3	3.32
Averages	......	......	......	......	32.0	3.39	......	......	......	......	48.2	3.23
NEW YORK.												
Moriches	13	64	11, 18	20	38.4	5.34	6	79	10	34	51.8	2.85
South Hartford	15	52	9	8	31.7	1.94	21	83	10	28	53.7	0.68
Germantown	......	......	......	......	......	......	20	82	......	......	......	......
Albany	15	59	18	20	37.6	1.16	20	86	7, 9	40	57.1	1.66
Fishkill	15	57	18	15	33.1	0.80	21	81	8, 9	32	51.7	1.92
Garrison's	13	59	18	13	24.4	1.98	20	83	9	30	48.0	2.51
Throg's Neck	13	60	18	14	33.5	......	22	75	8, 10	32	49.7	......
White Plains	......	......	......	......	......	......	20	78	9	29	48.7	......
Deaf and Dumb In.	13	67	25	18	38.6	2.28	21	82	8	37	53.7	4.09
Columbia College	13, 15	58	18, 25	18	34.8	1.70	21	79	8	34	50.3	2.40
Flatbush	16	51	25	16	34.8	1.49	22	83	9	34	50.1	2.71
Newburgh	15	56	18	13	33.7	0.50	21	84	8	32	51.1	1.90
Troy	15	54	18	13	32.8	1.08	20	82	9, 10	33	50.8	1.45
Gouverneur	14	50	10	0	27.0	2.61	18, 20	76	8	25	46.3	2.46
North Hammond	28	47	18	5	27.2	4.53	5, 12, 20	75	9	24	46.2	3.07

Meteorology of 1866—Continued.

Stations in States and Territories.	MARCH.						APRIL.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
NEW YORK—Con'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
South Trenton	4	50	18	—4	23.1	4.25	20	82	8	14	38.5	[illegible]
Oneida	14	64	17, 25	10	28.9	2.97	20	84	8	28	49.2	[illegible]
Depauville	3	48	17, 18	8	27.9	3.20	20	76	7, 8, 10, 26	31	46.4	[illegible]
Oswego	2	50	18	11	30.6	2.31	21	73	10	29	46.7	[illegible]
Palermo	3	50	17	5	26.1	2.30	20	84	9	25	46.1	[illegible]
Skaneateles	16	60	10	4	26.5	......	5	83	8	27	48.3	......
Baldwinsville	3	51	18	9	28.1	......	20	80	9	28	45.8	......
Nichols	14	68	10	9	32.3	......	5	86	8, 9	29	49.8	......
Geneva	2	58	17, 18	11	30.0	1.51	20	82	8	31	47.3	[illegible]
Rochester	14	59	10, 18	13	30.5	2.71	20	85	9	32	49.0	[illegible]
Rochester Univers'y	14	60	10	10	29.9	2.71	20	85	9	30	48.7	[illegible]
Little Genesee	14	61	18	7	29.3	......	28	84	9	23	47.6	......
Buffalo	1, 2	63	15	7	29.3	3.17	4	80	9	28	43.9	2.61
Jamestown	2	68	17, 18	6	18.9	......	......	......	......	......	......	......
Averages	......	......	......	......	30.7	2.41	......	......	......	......	45.0	[illegible]
NEW JERSEY.												
Paterson	13	64	18	12	34.8	1.98	21	84	8, 10	31	51.2	[illegible]
Newark	13	64	26	15	36.2	1.82	21	83	10	30	51.9	[illegible]
North Brunswick	13	67	18	17	35.9	1.68	21	80	8	33	54.6	[illegible]
Trenton	15	60	26	18	40.4	2.16	6	78	10	34	55.8	[illegible]
Burlington	13, 15	74	18	18	......	2.25	21, 22	80	10	32	53.7	4.00
Moorestown	15	74	26	19	38.8	2.07	21	82	8	35	52.8	[illegible]
Mount Holly	15	72	26	16	39.7	......	21	80	10	33	53.6	......
Seaville	15	68	10, 24	20	38.3	2.60	......	......	......	......	......	......
Haddonfield	15	75	26	17	38.4	1.90	21	81	10	31	53.6	3.17
Greenwich	13, 15	72	18, 26	19	40.5	0.79	21	79	10	35	53.8	[illegible]
Averages	......	......	......	......	38.1	1.92	......	......	......	......	53.4	3.06
PENNSYLVANIA.												
Nyces	15	64	18	6	30.0	1.65	5	84	9	23	47.5	[illegible]
Fallsington	13, 15	67	26	18	39.3	1.75	21	80	8	36	52.0	[illegible]
Philadelphia	15	71	26	19	41.2	2.03	21	82	8, 9	38	55.5	[illegible]
Germantown	15	75	26	14	37.7	......	21	85	9	34	52.8	......
Horsham	13, 15	70	18	18	38.0	1.15	21	80	8, 9	34	49.1	2.73
Dyberry	13	57	18	7	28.8	......	20	82	9, 10	22	47.1	......
Nazareth	13	70	17, 26	20	37.2	......	21	82	8, 9	35	54.1	......
North Whitehall	13, 15	58	18	12	35.3	......	21	84	10	26	51.5	......
Parkesville	15	72	18, 26	17	37.8	1.55	21	83	10	30	52.4	[illegible]
Ephrata	13	80	26	14	39.0	1.43	20	81	9	31	......	2.46
Silver Spring	15	70	26	16	38.0	......	20	84	9	32	53.9	......
Mount Joy	15	69	26	18	39.3	0.80	20	83	1	37	55.0	2.77
Harrisburg	15	62	18	21	39.2	0.72	20	82	8	36	55.2	[illegible]
Lewisburg	14	66	25	14	34.7	1.47	20	80	8	30	51.6	[illegible]
Tioga	2	68	9, 17, 18, 25	10	33.9	1.55	21	68	9	22	50.1	2.47
Fleming	14	79	18	7	33.4	2.77	17	82	10, 27	25	48.3	[illegible]
Pennsville	14	66	17, 25, 26, 27	10	31.0	4.70	20	83	9	26	48.3	[illegible]
Connellsville	14	76	10	7	36.8	......	20	88	8	27	55.1	......
Newcastle	14	63	10, 27	8	34.2	......	20	81	9	24	53.5	......
Canonsburg	14	66	27	6	34.7	3.24	......	......	......	......	......	......
Averages	......	......	......	......	35.9	1.91	......	......	......	......	51.7	[illegible]
DELAWARE.												
Delaware City	13	74	26	21	39.0	......	21	82	8, 9	37	53.8	......
MARYLAND.												
Woodlawn	14	73	18	19	41.8	1.63	21, 22	80	9	35	54.7	[illegible]
Catonsville	13	74	26	17	38.0	......	5	79	8	32	51.1	......
Annapolis	14	67	18	17	41.2	1.16	21	81	10	37	55.8	[illegible]

Meteorology of 1866—Continued.

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MARYLAND—Con'd.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
St. Inigoes	15	76	26, 27	20	44.6	1.21	21	80	7, 8, 9	40	56.4	3.55
Frederick	14	73	26	15	38.3	1.75	20	78	8, 10	32	54.3	3.25
Averages					40.8	1.44					54.5	3.65
VIRGINIA.												
Wytheville	15	72	27	17	41.6	......	4, 28	81	9, 11	31	56.0	......
WEST VIRGINIA.												
Cabell C. H.	20	72	17, 26	22	44.0	1.30	4	84	7	34	58.5	5.40
NORTH CAROLINA.												
Wilson	15	81	6	26	51.3	1.11	28	91	9	38	64.1	6.35
GEORGIA.												
Atlanta	14	78	18	24	51.8	3.04	27	91	11	36	62.4	4.21
ALABAMA.												
Moulton	......	......	......	......	......	......	31	76	8, 9	43	61.7	4.87
FLORIDA.												
Jacksonville	15	86	18	39	62.5	4.15	28	96	9, 10	52	74.3	1.70
TEXAS.												
Austin	20, 24	83	5	44	63.0	3.43	30	89	6	41	67.6	6.07
Chapel Hill	......	......	......	......	......	......	29, 30	86	......	......	......	......
MISSISSIPPI.												
Natchez	3, 20	78	17	40	60.6	4.10	3, 17, 18, 19, 21, 26, 27, 28, 30	80	9	38	65.8	9.50
Grenada	......	......	9	32	......	......	......	......	9	37	......	......
ARKANSAS.												
Helena	20	78	17	30	54.9	8.75	27	89	7	42	66.4	5.40
TENNESSEE.												
Clarksville	13, 31	71	17	24	47.3	5.08	27	89	7, 8	37	61.5	4.40
KENTUCKY.												
Louisville	31	71	26	18	43.0	8.07	27	87	9	30	60.0	2.57
Chilesburg	13, 14	70	26	18	44.2	3.17	4, 27, 28	82	9	28	58.2	3.83
Danville	13	74	5, 10, 17, 26	24	46.4	2.17	4, 19, 28	84	8	32	60.0	3.31
London	14	76	10	16	44.2	......	......	......	......	......	......	......
Averages					44.5	4.47					59.4	3.24
OHIO.												
Saybrook	2	67	18, 26, 27	9	30.0	......	4, 18	82	8, 9	28	49.5	......
New Lisbon	2, 14	68	27	8	36.4	4.75	20, 28	86	8, 10	28	55.6	2.78
East Fairfield	2, 14	63	10	12	33.3	4.71	28	82	8, 9	31	53.0	1.67
Steubenville	14	66	10, 27	15	39.0	......	20	83	9	32	57.2	......
Do	14	68	10	9	37.7	4.56	......	......	......	......	......	......
Smithville	......	......	......	......	......	......	19	90	9, 27	32	57.9	0.66
Weishfield	2	64	18	6	30.4	5.53	......	......	......	......	......	......
Milnersville	14	71	27	10	35.2	1.86	28	85	9	20	53.2	1.27
East Cleveland	2	69	10, 17, 18, 27	15	33,7	4.00	18	84	8	23	51.8	2.37
Wooster	2	64	10	9	32.5	......	28	88	9	28	54.5	......
Gallipolis	14	72	10, 26	17	42.6	2,78	4	85	8	31	57.3	3.61
Kelley's Island	1	54	17	14	31.7	2.81	18	75	8	30	49.6	1.11
Norwalk	2	66	10	12	32.5	2.56	4	84	9	29	52.5	2.38
Westorville	3	68	17	15	37.5	4.25	3, 19	81	8	30	57.3	1.63

Meteorology of 1866—Continued.

Stations in States and Territories.	March. Date.	March. Maximum temperature.	March. Date.	March. Minimum temperature.	March. Mean temperature.	March. Rain or melted snow.	April. Date.	April. Maximum temperature.	April. Date.	April. Minimum temperature.	April. Mean temperature.	April. Rain or melted snow.
OHIO—Continued.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Kingston	14	68	17	16	39.4	4.95	3	88	9	30	58.5	1.63
Toledo	2	58	26	13	31.8	3.75	18	82	7, 9	30	50.9	0.8[illegible]
Marion	2	60	17	11	34.0	4.10	4	80	9	28	53.7	2.23
Urbana University	2, 14	64	17	10	35.0	3.51	3, 4	82	8	30	55.8	1.[illegible]
Hillsboro'	2	68	17	13	38.2	5.75	4, 28	80	8, 9	29	56.1	2.23
Ripley	14	70	17	18	44.7	6.31	5	88	8	35	61.2	2.1[illegible]
Bothel	2	68	26	13	37.1	7.75	3, 4	82	9	28	55.0	1.90
Cincinnati	20	69	17	16	47.2	5.06	4, 27	85	8, 9	31	59.2	2.03
College Hill	20	66	17	12	38.9	5.06	4, 18, 28	82	9	30	58.0	3.61
Farm School	2, 20	66	26	13	37.4	4.64	28	82	9	28	57.0	3.16
Averages	......	......	......	......	36.4	4.43	......	......	......	......	55.2	2.05
MICHIGAN.												
Monroe City	2	54	17	9	31.2	3.20	26	77	8	28	50.3	0.60
State Ag. College	1	56	10	8	28.7	3.49	18	78	7	29	48.9	1.4[illegible]
Grand Rapids	......	......	......	......	......	......	18	86	7	27	51.6	......
Holland	1	56	26	0	28.8	3.52	18	79	7	24	47.7	2.08
Homestead	2	48	26, 27	—4	22.0	......	27	76	8	19	42.8	......
Averages	......	......	......	......	27.7	3.40	......	......	......	......	48.3	1.43
INDIANA.												
Balbec	31	60	17	7	33.1	......	4	88	9	28	55.8	......
Richmond	2	66	17	10	34.5	4.15	4	81	9	31	54.4	2.52
Aurora	20	72	17, 26	13	41.1	4.53	27	87	9	28	57.9	1.91
Vevay	31	75	5, 8, 17	18	42.1	5.72	28	97	7	33	61.8	1.69
Spiceland	2	67	17	9	35.6	4.70	4, 27	82	8	30	56.7	2.30
Madison	20	70	17	21	45.3	1.00	......	......	......	......	......	......
Columb'a City	2	66	17	10	33.2	6.55	17	81	8	26	52.5	1.50
Indianapolis	2	67	17	11	36.2	......	......	......	......	......	......	......
New Harmony	20	74	17	20	43.0	5.52	27	86	8	36	61.2	1.26
Averages	......	......	......	......	38.2	4.60	......	......	......	......	57.2	1.[illegible]
ILLINOIS.												
Chicago	1	52	17	4	28.2	......	27	84	5, 6, 7	26	44.1	......
Marengo	1	56	17	6	28.8	2.58	27	84	6, 8	28	48.7	2.5[illegible]
Riley	1	53	17	4	29.3	2.81	17	84	7	26	45.3	2.[illegible]
Golconda	31	82	17	19	43.6	5.88	17	90	8	32	64.3	2.05
Aurora	1	60	17	7	31.3	2.21	27	84	8	22	49.9	0.90
Sandwich	1	70	26	—1	29.8	2.77	27	83	1	25	50.5	1.65
Ottawa	1	64	17	10	32.5	1.97	18	84	......	......	......	1.62
Winnebago	1	58	17	2	27.7	2.00	27	84	5, 6	27	48.9	3.06
Hennepin	1	66	17	7	33.0	......	27	89	7	26	53.0	......
Wyanet	1	64	17	5	33.0	1.86	27	88	7, 9	26	52.3	1.90
Tiskilwa	1	66	25	11	33.3	......	27	86	6, 9	28	52.8	......
Elmira	1	65	17	6	33.0	1.93	27	88	6	27	53.4	2.0[illegible]
Peoria	1	64	17	12	34.9	2.46	27	87	6	32	56.3	2.[illegible]
Springfield	20	68	10, 24, 25	18	30.8	......	27	84	7	26	50.6	......
Loami	20	78	17	10	35.2	2.95	27	87	5, 7, 8	30	55.9	0.9[illegible]
Dubois	20	75	17	12	38.6	4.05	27	83	8	22	55.3	1.[illegible]
Galesburg	1	64	17	7	30.5	1.87	27	85	6, 7	30	51.5	2.[illegible]
Manchester	1	72	17	13	37.1	3.11	27	86	5	30	58.1	4.[illegible]
Clinton	......	......	24	18	......	......	......	......	7, 9	32	......	......
Mt. Sterling	20	76	17	6	36.2	......	27	86	5	30	57.5	......
Andalusia	1	64	17	8	33.3	......	29	89	1, 8	28	52.0	......
Augusta	1	68	17	6	36.1	1.77	17	81	7	26	54.2	4.[illegible]
Averages	......	......	......	......	33.1	2.68	......	......	......	......	52.8	2.30
WISCONSIN.												
Manitowoc	1, 31	49	17	—2	25.5	1.64	18	76	8	23	42.1	2.10
Milwaukee	1	54	17	9	29.4	1.56	18	76	6, 8	30	44.6	3.49
Ripon	1	56	17	—1	26.8	......	17	76	6, 8	24	46.2	......
Bloomfield	......	......	......	......	......	......	27	83	7	25	47.2	......
Delaware	1	55	17	4	27.1	1.29	27	80	6, 7	28	47.2	2.60

Meteorology of 1866—Continued.

Stations in States and Territories.	MARCH. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	APRIL. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
WISCONSIN—Con'd.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Waupacca	1	50	17	0	25.8	......	17	77	5, 7	27	46.2	......
Weyauwega	1	54	16	4	25.9	4.50	27	84	6	25	47.4	2.94
Embarrass	1	52	17	— 2	24.3	3.21	17	78	7	24	43.7	2.80
Rocky Run	1	49	17	3	26.3	1.20	27	82	7	22	47.0	4.22
Baraboo	2	53	17	10	29.2	1.22	27	82	7	28	49.7	5.19
Beloit	1	54	17	4	27.7	1.00	27	83	5	27	49.7	4.15
Plymouth	1	50	17	— 1	24.3	3.40	18	77	6, 7, 8	24	43.2	3.10
Odanah	30	52	17	—10	18.6	......	11.16	58	7	22	40.4	......
Bayfield	30	46	17	—10	18.7	......	......	......	......	......	......	......
Averages					25.4	2.11					45.7	3.40
MINNESOTA.												
Beaver Bay	1, 5, 23, 27	34	17	—18	17.6	0.00	28	58	8	19	39.1	3.20
Afton	1	45	17, 26	— 6	20.1	......	27	80	6	20	42.8	......
St. Paul	30	39	17, 26	— 8	18.8	1.32	27	76	6, 8	20	41.7	2.26
Minneapolis	14	43	26	— 8	17.8	1.07	27	82	6	19	42.3	2.59
Forest City	1	50	25	— 8	21.2	1.25	27	79	5, 8	18	43.8	3.20
Sibley	30	45	26	—14	17.5	0.61	27	82	6	17	43.0	1.93
New Ulm	30	47	13	— 8	20.8	1.40	27	85	5	23	46.6	1.98
Averages					19.1	0.64					42.8	2.53
IOWA.												
Clinton	1	62	17	2	31.3	3.75	27	86	6	28	52.3	2.00
Lyons	1	54	17	2	29.1	2.16	18	95	6	28	52.1	2.70
Davenport	1	57	17	7	29.9	2.81	27	81	6, 7	30	50.7	5.56
Dubuque	1	52	17	7	29.9	1.56	27	84	6	28	50.9	2.35
Muscatine	1	62	17	6	26.7	1.97	27	84	6, 7	26	52.1	1.91
Monticello	1	50	17	0	26.7	1.32	27	89	6	22	47.7	2.67
Fort Madison	1	63	17, 26	7	33.0	2.42	27	85	6	24	54.0	3.82
Guttenberg	1	45	17	3	26.1	0.59	......	......	......	......	......	......
Ceres	1	40	17	— 5	22.3	......	27	80	6, 8	22	41.2	......
Manchester	1	48	17	1	25.1	0.97	27	86	6	24	45.7	2.10
Mt. Vernon	1	60	16	5	29.3	......	27	83	6, 7	25	50.1	......
Iowa City	1	60	17	4	31.3	1.35	27	86	6	22	51.2	2.92
Independence	1	50	17	— 2	29.5	2.00	27	88	6, 7	21	48.9	4.30
Waterloo	30	51	17	2	27.7	......	27	82	6, 7	26	48.1	......
Iowa Falls	30, 31	44	17	0	23.0	1.05	27	80	5	21	46.4	4.71
Des Moines	1	61	17	5	30.0	3.75	27	86	5	26	52.2	4.25
Averages					28.2	1.98					49.6	3.27
MISSOURI.												
St. Louis	......	......	......	......	......	......	2	83	7	35	59.8	1.56
St. Louis Univer'y	20	82	17	16	42.8	2.62	27	91	5	37	60.7	1.73
Allenton	20	84	17	12	40.0	2.97	27	93	8	26	57.1	3.68
Athens	1	68	17	10	37.5	3.57	2, 17	80	6	28	55.6	3.63
Canton	1	69	17	8	35.0	2.13	......	......	......	......	......	......
Rolla	......	......	......	......	......	......	2, 17	82	8	30	59.4	6.12
Harrisonville	31	74	17	18	40.5	2.27	1	84	5	34	58.8	6.92
Union	20	84	17	16	42.2	2.17	27	89	6, 8	33	58.8	4.39
Averages					39.7	2.62					58.6	4.00
KANSAS.												
Leavenworth	30	74	17	12	36.2	1.81	27	90	6	24	56.5	2.93
Olatha	30, 31	73	16	15	35.6	......	26	87	5	28	55.9	2.93
Atchison	30	66	17	12	34.2	......	27	90	6	21	54.6	......
Burlington	......	......	......	......	......	......	16, 27	85	5, 7	30	59.2	4.43
Council Grove	30	73	4, 17	19	40.2	1.50	16	87	6	26	55.7	4.25
Averages					38.7	1.66					56.4	3.64

Meteorology of 1866—Continued.

Stations in States and Territories.	MARCH.						APRIL.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
NEBRASKA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Elkhorn	30	65	16	8	29.4	......	2	90	5	25	50.9	......
Bellevue	1	58	16	12	29.7	0.66	2	86	5	26	51.8	1.37
Glendale	30	71	15	— 1	29.4	2.30	2	91	5	22	51.6	3.19
Averages	......	......	......	......	29.5	1.48	......	......	......	......	51.4	2.28
UTAH TERRITORY.												
Great Salt Lake City.	31	66	14	25	44.1	2.73	25	80	2	31	49.2	3.35
CALIFORNIA.												
San Francisco	23, 30	62	1	44	51.5	3.59	23	82	1	45	55.1	0.00
Sacramento	24	68	13	40	56.0	2.02	24	86	3	45	61.9	0.48
Monterey	30	71	1	42	55.1	3.13	23	84	16	47	57.4	0.99
Meadow Valley	15, 16	66	3	26	41.5	19.05	23, 24	87	3, 17, 27, 28	34	44.0	0.70
Averages	......	......	......	......	51.0	6.95	......	......	......	......	54.6	0.54
MONTANA TER.												
Helena City	29	55	10	— 4	25.4	1.76	23	72	4	17	38.3	2.90
WASHINGTON TER.												
Neeah Bay	13, 24, 25	50	27	22	43.0	17.00	23, 24	56	12, 13	34	44.7	11.70

Stations in States and Territories.	MAY.						JUNE.					
MAINE.												
Steuben	12	69	1	36	49.7	7.90	26	87	1	44	60.1	2.45
Lee	12	80	8	32	50.7	6.05	27	90	9	44	62.3	......
West Waterville	12	80	1	37	53.4	3.35	26	89	1, 11	50	64.5	4.30
Gardiner	12	72	17	40	53.1	4.97	26	83	1, 9	48	62.5	3.50
Lisbon	......	......	15	32	......	4.83	26	92	......	......	......	3.15
Webster	12	75	1	36	52.8	......	26, 27	87	1	48	63.5	......
Standish	13	82	3	38	53.4	3.85	25	95	9	47	66.3	4.55
Cornish	12	80	4	35	52.0	3.10	25, 27	90	1	46	63.7	4.20
Cornishville	12	79	3	38	53.3	3.51	27	90	1	48	61.8	4.98
Averages	......	......	......	......	52.3	4.70	......	......	......	......	63.1	4.16
NEW HAMPSHIRE.												
Stratford	20	77	2	30	47.1	3.72	25	85	1	38	61.5	4.87
Shelburne	13	82	8	29	50.7	......	26	92	1	38	63.6	......
North Barnstead	12	80	2	38	54.1	3.40	25, 26	90	1	46	......	......
Concord	12	82	7	41	55.7	3.25	25	94	1	50	66.8	2.00
Claremont	12	81	15	32	53.3	3.75	25	94	1	40	66.5	3.60
Averages	......	......	......	......	52.2	3.53	......	......	......	......	64.6	3.49
VERMONT.												
Lunenburg	10, 11	80	15	18	45.1	3.00	......	......	......	......	......	......
Craftsbury	20	77	1	29	46.8	3.15	25	84	1	40	61.3	2.70
Randolph	12	80	1, 15	31	50.1	1.87	25	90	1	37	64.7	3.54
Middlebury	12, 20	74	1, 2, 3	36	51.9	2.05	25	85	1	43	65.2	3.92
Brandon	20	86	2	31	49.0	2.22	25	94	1	44	66.1	3.22
Barnet	12, 19, 20	85	1, 3	35	52.8	3.25	26	100	1	40	67.6	4.75
Wilmington	20	81	3	40	53.0	......	25, 26	92	3, 30	51	65.7	......
Averages	......	......	......	......	49.8	2.59	......	......	......	......	65.1	4.00

Meteorology of 1866—Continued.

Stations in States and Territories.	MAY. Date.	MAY. Maximum temperature.	MAY. Date.	MAY. Minimum temperature.	MAY. Mean temperature.	MAY. Rain or melted snow.	JUNE. Date.	JUNE. Maximum temperature.	JUNE. Date.	JUNE. Minimum temperature.	JUNE. Mean temperature.	JUNE. Rain or melted snow.
MASSACHUSETTS.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Topsfield	13	82	2	42	55.6	5.34	25, 26	92	9	49	69.6	2.79
Lawrence	13	77	1	38	50.9	4.65	26, 27	90	9	47	63.8	2.71
Georgetown	......	......	......	......	......	......	26	93	1	47	66.0	......
Newbury	13	80	2	40	55.1	......	25	93	1	48	66.6	......
North Billorica	13	80	1	40	55.3	......	25, 26	92	9	48	63.3	......
New Bedford	28	72	1	36	53.6	4.02	26	87	9	50	60.2	4.00
Worcester	13	76	2	40	54.2	5.33	26	88	1	51	66.0	3.40
Mendon	12	77	2	39	54.4	5.05	26	88	9	49	64.5	4.80
Amherst	12	80	1, 2	40	54.6	4.48	25, 26	90	1	48	65.8	5.66
Springfield	12	85	1	32	53.7	5.86	26	97	1	42	65.8	4.88
Westfield	13	77	24	37	54.3	5.54	......	......	......	......	......	......
Richmond	12	82	3, 7, 15	34	57.9	6.82	25	94	1	42	68.0	5.31
Williams College	13	78	1, 15	37	52.3	3.38	25	89	1, 16	52	64.6	4.38
Averages	......	......	......	......	54.3	5.05	......	......	......	......	65.8	4.21
RHODE ISLAND.												
Newport	26	71	2	42	54.4	4.50	26	84	9	52	66.0	4.13
CONNECTICUT.												
Pomfret	16	77	......	......	......	......	26	87	1	48	63.4	5.15
Columbia	12	83	2	40	57.0	......	26	95	1, 8	50	66.9	......
Middletown	20	83	3	40	56.9	5.38	26	97	2	52	69.2	3.02
Colebrook	20	82	3	35	52.7	......	26	91	1	51	65.6	......
Groton	12	68	3, 4	38	53.5	5.81	26	86	1, 9	45	......	4.30
Averages	......	......	......	......	55.0	5.60	......	......	......	......	66.3	4.16
NEW YORK.												
Moriches	19	79	1, 3, 4	45	58.7	6.62	26	95	9	56	69.7	2.56
South Hartford	12, 20	85	5	32	59.9	1.06	25	93	2	53	68.6	3.65
Troy	12	78	1	41	58.2	2.43	25	93	1	53	68.7	6.71
Germantown	10	90	3	40	55.9	4.30	26	96	1	50	67.8	6.80
Fishkill	12	79	3, 4	41	56.7	4.63	25	90	1	53	69.9	4.41
Garrison's	20	77	2	39	54.0	4.44	25, 26	92	1	50	66.0	5.64
Throg's Neck	19	80	2	39	52.8	......	25, 26	90	10	52	67.9	......
White Plains	13	80	2	36	55.2	......	25, 26	87	1, 4	56	68.6	......
Deaf and Dumb In.	16, 21	74	2	38	56.5	4.46	26, 27	88	1, 2	54	68.6	4.38
Columbia College	13	81	2	39	57.6	3.59	26	92	2, 3	54	68.9	2.35
Flatbush	......	......	......	......	......	......	26	92	5	48	61.6	2.23
Newburgh	12, 16	81	2	41	58.3	4.40	26	93	1	55	69.0	4.40
Gouverneur	20	85	2	36	51.5	3.06	25	87	1	50	64.7	4.14
North Hammond	......	......	......	......	......	......	24	88	1	42	64.9	8.74
South Trenton	10, 11	80	15	31	50.7	4.21	25	91	1	40	64.5	7.14
Oneida	20	82	4	31	52.4	4.37	26, 27	90	29	42	65.8	10.43
Depauville	20	80	1	35	50.2	3.74	25	84	1	46	63.9	4.03
Oswego	20	81	2,3,14,17	38	51.3	2.88	25	86	1	46	62.1	4.81
Palermo	20	82	1	34	49.7	2.70	25	91	1	39	63.4	4.80
Skaneateles	20	82	2, 3	36	51.7	......	25	92	1	50	64.7	......
Baldwinsville	12	76	14	36	50.3	......	25	86	1	42	63.8	......
Nichols	20	88	3	37	54.4	......	25	96	1	45	66.6	......
Geneva	20	85	3	37	51.3	2.27	25	89	1	48	65.2	4.42
Rochester	20	84	1	38	52.4	2.90	25	91	1, 19	52	66.2	3.90
Rochester Univer'ty	20	86	2, 3	37	52.4	2.90	25	91	1, 19	54	66.9	3.90
Little Genesee	20	87	3, 4, 6, 15	32	49.1	......	25	92	1	40	66.8	1.75
Buffalo	19	81	2	37	50.0	4.86	26	86	1	48	64.0	2.85
Averages	......	......	......	......	53.6	3.67	......	......	......	......	65.9	4.73
NEW JERSEY.												
Paterson	13	84	2	38	57.7	3.72	26, 27	91	1	53	68.8	4.60
Newark	13	81	4	39	57.4	4.40	25, 26, 27	89	1	50	67.6	2.51
New Brunswick	13	84	2	40	59.1	4.30	23, 26	92	19	56	69.7	2.91
Trenton	13	81	2	46	61.2	4.68	26	93	1,2,4,10, 19, 20	60	75.1	3.66

Meteorology of 1866—Continued.

Stations in States and Territories.	May. Date.	May. Maximum temperature.	May. Date.	May. Minimum temperature.	May. Mean temperature.	May. Rain or melted snow.	June. Date.	June. Maximum temperature.	June. Date.	June. Minimum temperature.	June. Mean temperature.	June. Rain or melted snow.
NEW JERSEY—C'd.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Burlington	13	80	2, 3	44	58.9	4.05	25, 26	89	1	57	70.5	3.90
Moorestown	13	79	2, 3	43	59.0	3.75	26	95	1	56	71.0	2.41
Mount Holly	13	81	4	40	58.9	......	26	91	2	56	70.7	......
Seaville	......	......	......	......	......	......	24	91	11	58	72.5	3.80
Haddonfield	13, 27	78	3	41	59.4	5.34	26	95	1, 2	57	71.7	2.47
Greenwich	13	77	3	41	58.9	3.45	26	90	1	57	71.3	2.86
Averages	......	......	......	......	59.0	4.16	......	......	......	......	70.9	3.16
PENNSYLVANIA.												
Nyces	20	80	2	31	53.0	3.30	23, 25	89	3, 18	51	64.7	8.30
Fallsington	13	79	3	41	59.0	3.70	26	91	2, 4	57	69.5	2.90
Philadelphia	13	83	3	46	61.5	4.63	26	97	2	58	73.7	3.39
Germantown	20, 27, 31	79	2	41	......	......	26	94	1	55	72.2	......
Horsham	13	78	2, 3	43	58.3	4.15	25, 26	87	1, 2	55	69.0	5.00
Dyberry	20	82	3, 23	33	42.2	......	......	......	......	......	......	......
Nazareth	12	84	1	42	59.6	......	26	93	3	53	69.1	......
North Whitehall	12	77	15	33	55.3	......	25, 26	88	1	51	67.8	......
Parkesville	20	81	3	42	58.8	4.32	26	96	1	56	72.0	3.94
Stevensville	......	......	......	......	......	......	25	95	1	48	68.6	4.34
Ephrata	12	83	4, 23	38	58.3	2.92	25, 26	92	1	55	90.9	7.31
Silver Spring	27	83	3	38	59.4	......	26	94	11	52	70.6	......
Mount Joy	21	85	2, 3	46	64.8	2.15	26	98	18	59	72.4	2.35
Harrisburg	20	83	3	43	62.6	2.98	26	94	4	62	73.9	5.78
Lewisburg	20	85	23	38	57.7	3.48	25	92	18	54	69.1	3.64
Tioga	12, 20	86	3	28	52.7	2.15	24, 25, 26	94	1, 29	46	67.7	3.45
Fleming	20	90	4	30	53.9	1.44	25	90	16	44	65.7	4.81
Pennsville	20	90	3	32	53.3	1.58	26	92	18, 29	48	66.0	4.38
Connellsville	20	88	3	33	57.5	......	25	92	18	50	69.7	......
New Castle	20	82	3	30	56.2	......	25	88	29	46	68.9	......
Canonsburg	18	82	3	33	57.2	1.07	26	91	29	51	69.3	4.64
Averages	......	......	......	......	56.9	2.91	......	......	......	......	70.5	4.59
DELAWARE.												
Delaware City	13	82	3	43	60.6	......	......	......	......	......	......	......
MARYLAND.												
Woodlawn	20	82	3	42	60.8	3.96	25, 26	90	3	59	71.4	9.35
Catonsville	16, 20	79	3	42	60.3	......	25	90	18	56	71.6	......
Annapolis	31	79	3	45	62.2	4.33	27	92	19	60	74.6	8.11
St. Inigoes	25	84	3	45	60.4	4.59	......	......	......	......	......	......
Frederick	20	83	2, 3	40	60.0	1.50	25	91	29	59	77.8	6.75
Averages	......	......	......	......	60.7	3.60	......	......	......	......	73.9	8.07
VIRGINIA.												
Wytheville	20	83	3	40	50.5	......	25	89	29	48	63.9	......
WEST VIRGINIA.												
Romney	20	88	3, 14	36	56.2	......	24, 25	94	29	48	67.3	......
Cabell C. H	19, 20	85	5	40	61.0	1.70	12	91	17, 18, 29	56	70.2	5.10
Averages	......	......	......	......	58.6	1.70	......	......	......	......	68.8	5.10
NORTH CAROLINA.												
Wilson	20	92	5	50	67.3	1.85	......	......	19	60	......	4.90
Statesville	......	......	......	......	......	......	13, 14	94	19*	47	71.1	4.75
Averages	......	......	......	......	67.3	1.85	......	......	......	......	71.1	4.83
GEORGIA.												
Atlanta	1, 19, 20	82	30	42	63.6	6.87	9, 10, 12, 13	88	19	44	69.6	4.89

Meteorology of 1866—Continued.

Stations in States and Territories.	MAY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	JUNE. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
ALABAMA.												
Moulton	......	......	......	......	......	......	25	90	20	57	73.8	5.01
MISSISSIPPI.												
Natchez	28	86	30	54	70.9	9.85	26	80	18	50	76.0	5.65
Grenada	......	......	......	......	......	......	25	88	30	52	......	......
FLORIDA.												
Jacksonville	27	97	5	65	78.6	2.95	13	100	18, 21	65	81.5	4.13
Gordon	......	......	......	......	......	......	12, 13	98	18	62	79.1	......
Averages	......	......	......	......	78.6	2.95	......	......	......	......	80.3	4.13
TEXAS.												
Austin	27	93	29, 30	57	73.9	5.46	20	95	4	62	81.3	2.15
Chapel Hill	28	92	28	60	71.6	4.05	3	92	18, 29	64	79.8	4.05
Averages	......	......	......	......	72.8	4.76	......	......	......	......	80.6	3.10
ARKANSAS.												
Helena	27	93	29	54	70.9	7.38	24, 26	94	29	58	76.4	8.87
TENNESSEE.												
Clarksville	19	84	2	44	62.9	2.11	11, 25	88	19, 30	55	71.3	2.84
Lookout Mountain	20	88	......	......	......	......	12, 24	95	17	54	71.9	......
Averages	......	......	......	......	62.9	2.11	......	......	......	......	71.6	2.84
KENTUCKY.												
Louisville	19	89	5	36	61.0	1.84	26	92	19, 29	46	72.1	6.48
Chilesburg	19	86	2	43	61.3	2.03	......	90	29	45	70.4	4.91
Taylorsville	26	89	2	44	63.2	1.21	25	94	30	58	75.0	4.07
Averages	......	......	......	......	61.8	1.69	......	......	......	......	72.5	5.15
OHIO.												
New Lisbon	20	90	3	35	56.9	1.46	25	96	1	45	70.4	11.19
East Fairfield	20	85	3	36	55.4	1.91	25, 26	85	29	49	67.2	6.43
Steubenville	20	91	4	31	60.3	2.50	13, 25, 26	87	29	52	72.2	7.04
Milnersville	19	86	4	25	47.4	1.15	8	92	19, 28	47	65.2	5.41
East Cleveland	12	84	2	32	54.9	4.04	12	92	18	51	68.8	9.80
Wooster	19	87	3	39	57.0	......	12, 25	95	18, [illegible]	52	71.3	......
Gallipolis	20	87	2, 3, 4	40	59.7	0.73	23	93	18	51	70.9	3.59
Kelley's Island	11	78	2	41	56.3	3.77	23, 25	89	18	53	69.1	7.42
Norwalk	18	82	1	37	55.2	3.22	8, 24, 26	90	18	49	67.4	6.22
Westerville	19	87	2, 4	43	61.0	1.22	8	90	28	51	71.2	5.10
Kingston	19	89	2	43	60.2	1.67	12	94	28	52	71.6	3.01
Toledo	19	84	3	34	55.8	5.38	24	92	18	47	67.4	4.69
Marion	19	82	2, 3	38	56.5	3.37	24, 25	87	18	50	68.6	4.76
Kenton	......	......	......	......	......	......	24	94	18	52	75.0	7.75
Urbana University	19	88	2	39	58.7	1.59	8, 12	88	18	47	69.3	5.54
Hillsboro'	19	84	2	39	58.7	1.11	12, 25	88	18	51	69.7	4.32
Ripley	......	......	......	......	......	......	24	100	18	53	66.4	3.96
Bethel	18	88	2	35	57.3	0.63	8, 12	92	28	49	66.7	2.38
Cincinnati	19	88	2	42	61.6	0.94	25	90	18	50	72.7	4.44
College Hill	19	88	3, 4	40	59.4	0.88	25	95	18	52	71.8	5.25
Farm School	19	86	4	38	58.5	1.63	25	93	28	49	70.9	5.25
Averages	......	......	......	......	57.4	2.07	......	......	......	......	69.7	5.68

Meteorology of 1866—Continued.

Stations in States and Territories.	MAY. Date.	MAY. Maximum temperature.	MAY. Date.	MAY. Minimum temperature.	MAY. Mean temperature.	MAY. Rain or melted snow.	JUNE. Date.	JUNE. Maximum temperature.	JUNE. Date.	JUNE. Minimum temperature.	JUNE. Mean temperature.	JUNE. Rain or melted snow.
MICHIGAN.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Monroe	19	79	1	38	57.1	2.89	24	88	18	49	69.2	3.21
State Agr'l College	19	80	1, 2	35	54.7	3.48	8, 12, 24	86	18	46	66.5	5.57
Litchfield							24	91				
Grand Rapids	19	94	2	34	55.8		24	90	18	48	66.8	
Northport							24	88	1	42	59.8	
Holland	19	85	2	32	51.8	2.50	8	94	18	48	66.3	4.80
Ontonagon							24	84	2	44	60.1	
Homestead	19	89	1, 2	32	50.1		8, 20	86	27	46	65.4	
Averages					53.9	2.96					64.9	4.40
INDIANA.												
Richmond	19	85	2	39	57.2	1.70	25	90	28	51	69.1	4.62
Aurora	19	94	4	36		1.56	25	100	29	50	71.8	5.10
Vevay	18	98	3	44	64.4	1.50	12	99	29	50	77.8	5.[illegible]
Spiceland	19	91	2	39	59.3	1.70	25	96	18	51	71.3	4.25
Madison	19	84				1.08	13, 25, 26	91	17	60	76.4	2.56
Columbia City	19	89	3	36	55.2	6.13	25	96	16, 28	49	68.1	3.05
Merom	19	90					25, 26	91	18	52	72.1	3.3[illegible]
New Harmony	19	88	2	45	63.1	1.08	26	94	18	54	74.6	2.50
Averages					59.8	2.11					72.7	3.[illegible]
ILLINOIS.												
Chicago	19	98	2	34	54.4		24	100	18	48	70.7	
Marengo	19	89	2	34	54.8	2.61	11	91	17	47	66.5	3.93
Riley	19	93	2	34	52.2		25	92	19	42	66.4	3.65
Golconda	26	94	3	40	68.7	3.30	8	95	19	44	76.2	2.67
Aurora	19	89	28	28	56.4	1.67	24	90	28	47	66.9	2.74
Sandwich	19	90	1, 2	38	57.9	3.19	25	95	28	49	68.4	5.22
Ottawa	19	93	1, 2, 3, 5	42	58.9	2.16	25	101	28	50	69.0	1.[illegible]
Winnebago	19	91	2	35	56.8	1.90	11, 24	90	16	50	68.2	4.45
Wyanet	18, 19	88	2	32	56.8	1.90	25	92	1	49	68.4	2.73
Tiskilwa	19	92	7	36	59.1		25	99	16	50	69.3	
Elmira	19	90	2	38	60.2	1.63	25	92	1	51	69.8	2.62
Hennepin	19	90	2, 17	31	58.0		25	92	1	43	67.0	
Peoria	19	88	2	39	60.7	2.57	24, 25	92	17, 18	54	70.9	2.[illegible]
Springfield	25	89	2	36	58.5		25	94	2, 17, 18	50	69.8	
Loami	19	89	1	41	60.6	3.10	25	96	28	53	71.1	2.90
Dubois	18	88	2	31	57.7	2.25	26	88	29	40	64.1	2.40
Hoyleton	19	91	1, 2	45	60.4	1.35	25	98	29	48	73.0	5.75
Galesburg	19	85	2	35	58.0	1.24	24	88	16	51	68.7	0.83
Manchester	19	89	1	44	63.6	4.95	25	93	16, 18	55	72.1	1.22
Mount Sterling	18, 19	84	1	40	62.7		24	93	16, 18	54	76.7	
Andalusia	19	86	2	35	56.7		25	93	19	47	75.6	
Augusta	19	82	2	39	61.2	2.12	25	87	16	54	72.8	1.74
Averages					58.8	2.40					70.1	3.30
WISCONSIN.												
Manitowoc	12	74	1, 2	33	49.8	1.78	24	89	1	45	62.2	5.39
Plymouth	19	86	2	31	51.6	2.20	24	90	16	45	65.0	6.00
Milwaukee	9, 20	74	1	35	51.3	2.64	24	89	1	46	64.5	6.15
Ripon	19	86	2	35	55.3		22	88	18	50	68.3	
Geneva	19	83	2	32	54.9		11, 24	90	17, 18	50	67.7	
Delavan	19	87	1	35	54.6	2.05	11, 24	88	17	47	66.9	2.22
Waupacca	19	91	1	32	56.5		24	90	11, 17	52	68.6	
Weyauwega	19	87	1, 2	38	55.0	1.00	24	92	27	50	68.4	
Embarrass	19	97	2	28	55.5	1.69	24	95	18	40	65.5	5.05
Rocky Run	19	91	2	34	56.0	3.70	24	88	16	51	67.4	6.30
Beloit	19	89	1, 2	38	57.4	0.55	24	89	6	45	68.5	[illegible]
Baraboo							24	90	16	50	69.0	5.50
Bayfield	24	72	2	28	56.0							
Averages					54.5	1.95					66.8	4.34

Meteorology of 1866—Continued.

Stations in States and Territories.	MAY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	JUNE. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MINNESOTA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Beaver Bay	17	75	1	32	48.3	1.02	25	67	11	40	58.2	3.34
Afton	19	93	1, 2	31	56.7	......	3	89	16, 18	51	65.7	......
St. Paul	19	86	1	31	54.8	0.39	20	84	16, 18	51	64.0	6.00
Minneapolis	19	87	1	30	58.7	0.65	20	88	17	51	67.2	7.28
Forest City	25	87	1, 3	32	59.0	0.00	......	......	......	......	......	......
Sibley	25	88	1	30	59.0	0.03	3, 25	87	16	49	66.4	2.44
New Ulm	18, 19, 25	85	1	34	61.4	0.35	25	92	28	51	69.6	3.75
Averages	......	......	......	......	56.8	0.41	......	......	......	......	65.2	4.56
IOWA.												
Clinton	18	94	2, 7	38	60.1	2.65	24	94	16, 17, 18, 29	50	69.3	4.80
Lyons	18, 19	90	2	28	61.1	1.87	22, 24	94	18	50	69.7	4.16
Davenport	19	85	16	33	57.8	4.80	25	89	16	52	66.4	9.77
Dubuque	19	89	1	41	59.0	1.91	24	90	1	52	68.8	4.38
Muscatine	19	88	2	34	59.3	1.18	......	......	......	......	......	......
Fort Madison	19	87	2	37	60.6	3.16	25	93	18	54	71.7	2.48
Monticello	19	90	1	33	56.9	3.16	24	87	16	48	69.7	4.00
Ceres	19	86	31	31	51.3	......	24	92	16	44	67.5	......
Manchester	19	88	2	35	56.3	1.13	24	87	16	48	68.0	4.67
Mount Vernon	19	91	2	31	58.2	......	24	89	16	49	68.0	......
Iowa City	25	84	2	35	59.2	1.59	24	90	18	48	67.9	4.76
Independence	18, 19	93	2	34	58.7	2.20	24	96	17	47	67.6	8.00
Waterloo	19	87	2	34	56.6	......	24	94	28	48	65.3	......
Osage	19	93	1	32	57.6	......	24	93	17	51	67.8	......
Iowa Falls	26	82	2	34	58.7	1.95	23, 24	86	18	34	64.7	7.16
Des Moines	19	89	31	31	61.8	0.75	24	91	28	48	68.1	4.00
Fontanelle	18, 19	88	1, 2	36	58.2	3.56	25	92	16	52	69.0	6.56
Harris Grove	18	90	2	33	58.2	0.12	25	87	9, 28, 29	46	65.2	3.10
Averages	......	......	......	......	58.3	2.15	......	......	......	......	67.6	5.21
MISSOURI.												
St. Louis	12, 18, 19	87	2	45	64.2	2.24	25	94	17, 18	58	74.3	5.59
St. Louis Univer'ty	19	87	2	47	65.4	2.27	25	93	18	59	75.3	5.35
Allenton	19	88	3	40	59.9	3.04	7, 25	91	18, 19, 29	47	68.7	3.32
Union	12	89	2	44	63.4	2.50	25	93	17, 28	56	72.8	4.36
Athens	18	93	17	40	62.3	0.73	28	98	17, 30	58	74.5	2.50
Canton	......	......	1	42	......	2.13	......	......	......	......	......	......
Rolla	18	86	29	32	61.9	2.85	25	91	28	50	70.8	2.37
Harrisonville	19	86	2	42	61.4	5.42	26	92	16	52	67.1	4.18
Averages	......	......	......	......	62.6	2.65	......	......	......	......	71.9	3.95
KANSAS.												
Leavenworth	18, 25	90	14	40	60.8	6.04	21	96	29	47	69.3	9.25
Olathe	25	87	1, 2	42	61.2	4.30	25	91	16	51	70.5	10.60
Atchison	11, 17, 19	82	29	42	60.4	......	......	......	......	......	......	......
State Agric. College	18	90	2, 28	45	61.9	2.83	24, 25	94	16	54	71.8	3.60
Burlington	25	90	2	41	62.4	3.14	25	94	28	54	71.7	5.46
Council Grove	18	82	2	41	59.0	7.60	24, 25	88	28	50	66.6	11.70
Averages	......	......	......	......	73.1	4.78	......	......	......	......	70.0	8.12
NEBRASKA.												
Elkhorn	18	93	1	37	61.3	......	24	93	5	52	68.7	......
Bellevue	18	90	1, 29	38	60.7	1.91	24	94	4, 6, 17	50	68.3	5.27
Glendale	19	92	1	36	60.2	1.85	7	95	16	46	68.0	5.93
Averages	......	......	......	......	60.7	1.88	......	......	......	......	68.3	5.60

Meteorology of 1866—Continued.

Stations in States and Territories.	MAY.						JUNE.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
UTAH TERRITORY.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Great Salt Lake City	17	82	8	40	58.7	......	17	88	7	45	65.4	5.34
Wanship	17	82	25	34	56.3	......	27	92	6	36	54.8	......
Averages	......	......	......	......	57.5	......	......	......	......	......	60.1	5.34
CALIFORNIA.												
San Francisco	16	71	5	46	54.3	0.00	26	80	1, 8, 10, 11, 16, 17, 21, 22, 23, 28	53	57.6	0.15
Sacramento	16	91	5	45	63.1	2.25	16	96	8	55	72.2	0.10
Monterey	16	77	4, 5	47	52.7	0.80	26	84	6, 7, 11, 19	53	56.8	0.14
Meadow Valley	15, 16	85	4	35	54.0	2.95	30	97	7	40	63.9	1.75
Averages	......	......	......	......	56.0	1.50	......	......	......	......	62.6	0.54
OREGON.												
Albany	......	......	......	......	......	5.34	......	......	......	......	......	......
Corvallis	......	......	......	......	......	......	31	92	13	47	......	......
MONTANA TER.												
Helena City	23	65	1, 2, 6	30	41.3	4.30	27, 30	78	3	36	60.3	3.50
WASHINGTON TER.												
Neeah Bay	8	62	3	36	50.1	6.20	27, 29	64	11	45	54.4	7.50

Stations in States and Territories.	JULY.						AUGUST.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MAINE.												
Steuben	13	90	19	55	74.6	4.30	3	75	24	48	57.3	4.3[illegible]
Lee	7, 8, 13	88	19	54	66.7	3.75	13, 14	82	25	48	64.0	[illegible]
Barnard	12	88	22	57	69.1	5.45	12, 13	76	21, 27	50	61.3	7.1[illegible]
West Waterville	7, 17	91	19	58	72.2	2.90	12, 13	80	16, 20, 24, 25	54	64.4	4.8[illegible]
Gardiner	17	89	19	58	66.5	3.01	3, 4, 12	75	24, 25	53	63.3	5.5[illegible]
Lisbon	17	97	......	......	......	3.30	......	......	......	......	......	5.6[illegible]
Webster	7, 8	90	19	57	71.2	......	12	78	26	49	62.9	......
Standish	17	98	19	58	74.3	2.57	......	......	......	......	......	......
Cornish	17	93	23	57	71.6	3.40	2	82	21, 26	50	62.4	5.40
Cornishville	17	96	23	58	73.5	2.14	18	81	23	52	64.5	5.9[illegible]
Averages	......	......	......	......	71.1	3.42	......	......	......	......	62.5	4.9[illegible]
N. HAMPSHIRE.												
Stratford	16	88	20	52	67.2	6.68	2	80	17, 21	43	59.2	5.00
Shelburne	16	96	2	48	......	......	12, 28	80	25	42	60.9	......
North Barnstead	16, 17	96	23	58	73.4	3.54	12	85	23, 24	52	65.0	3.5[illegible]
Claremont	16	95	1	50	73.0	4.97	2	84	18, 24	50	64.0	5.9[illegible]
Averages	......	......	......	......	71.2	5.04	......	......	......	......	62.3	4.8[illegible]
VERMONT.												
Lunenburg	......	......	......	......	......	......	1	88	16, 17, 20	45	60.9	5.0[illegible]
Craftsbury	16	86	1, 20	54	67.0	5.62	2	78	17, 24	46	57.8	5.55
Randolph	16	98	23	53	71.2	2.81	2	82	17	44	67.2	2.[illegible]
Middlebury	16, 17	88	1, 18, 19, 20	58	70.8	5.39	2	78	16, 17	48	61.9	3.1[illegible]
Brandon	16	96	18	56	72.1	2.07	3	86	17	46	64.9	3.[illegible]

Meteorology of 1866—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
VERMONT—Cont'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Barnet	17	100	22	50	74.4	4.50	2	87	15, 17, 21, 28	54	70.0	3.50
Wilmington	13	94	1	52	72.0	......	2	85	26	47	61.2	......
Averages	......	......	......	......	71.3	4.08	......	......	......	......	63.4	3.90
MASSACHUSETTS.												
Kingston	17	102	1	54	74.0	6.75	1, 18	82	25	52	66.0	3.65
Topsfield	17	97	19, 23	61	74.9	5.64	1	82	24	52	66.9	3.00
Lawrence	16	95	1	58	72.4	4.67	1	78	21, 23	52	62.7	2.41
Newbury	17	99	1	58	73.6	......	1	85	24	50	64.4	......
North Billerica	16, 17	98	2, 22	60	74.2	......	17, 18	80	21, 25	50	65.7	......
New Bedford	16	94	1	59	72.1	1.76	1	78	23	53	65.8	3.48
Worcester	16, 17	94	1, 22	60	73.7	3.78	2	80	23, 24	52	65.0	3.32
Lunenburg	......	......	......	......	......	......	2	83	25	48	64.4	......
Mendon	16	92	1, 21	58	73.1	4.73	1, 2	81	25	50	64.4	2.50
Amherst	16	94	18	52	72.9	4.02	2	82	28	48	63.5	3.96
Springfield	16, 17	103	1	48	74.1	3.00	1, 2, 18	85	17	44	64.7	2.83
Richmond	17	94	5	54	74.7	2.71	1, 4, 31	80	25	44	63.6	6.02
Williams College	16, 17	91	1	53	69.3	3.70	2	82	25, 26	49	59.8	3.38
Averages	......	......	......	......	73.3	4.08	......	......	......	......	64.4	3.46
RHODE ISLAND.												
Newport	16	90	21, 22	58	71.1	1.81	2	83	24, 25	52	64.9	3.78
CONNECTICUT.												
Pomfret	16, 17	91	21	57	71.5	3.58	2	77	23	50	66.4	3.10
Columbia	17	100	22	60	76.2	......	18	84	25	50	66.7	......
Middletown	16, 17	100	1, 27	60	75.7	4.04	2	87	25	53	......	4.24
Colebrook	15, 16	92	1, 2	56	72.6	......	2	83	24, 25, 26	50	63.8	......
Groton	16	92	1	55	77.0	2.30	2	81	23, 25	52	66.4	3.93
Averages	......	......	......	......	74.6	3.31	......	......	......	......	65.8	3.76
NEW YORK.												
Moriches	13, 16	102	1	65	78.6	5.47	8	89	25	26	71.4	6.63
South Hartford	16, 17	97	19	62	76.7	2.46	2	84	16	50	66.6	4.34
Troy	16, 17	96	1, 31	62	75.6	3.85	......	......	......	......	......	......
Germantown	16	102	1	56	77.9	1.10	2	92	26	51	65.7	6.20
Fishkill	17	100	1, 29	60	72.5	3.40	2	85	25	51	71.4	4.75
Garrison's	17	98	1	54	74.0	3.83	1, 2	84	23, 25	53	66.0	5.29
Throg's Neck	17	99	1	60	75.9	......	2	85	23	51	67.6	......
White Plains	8, 13, 15	92	1, 4	64	77.0	......	2	84	25, 26	54	63.4	......
Deaf & Dumb Inst'n	......	......	......	......	......	......	5	90	25	53	69.5	4.81
Columbia College	17	99	21	62	79.0	1.67	2	85	24	57	70.5	3.84
Flatbush	13, 17	98	1	63	79.2	3.32	2	96	9, 16, 24	55	69.8	4.38
Newburgh	17	99	1	62	76.8	4.10	2	86	25, 26, 27	54	67.0	5.50
Gouverneur	16, 17	90	1	48	71.7	2.45	3	77	12	40	61.5	5.96
North Hammond	13, 16	92	1	56	72.7	3.21	12	84	16	44	72.3	9.63
South Trenton	17	91	19	52	72.5	5.07	1	80	16	42	59.8	4.49
Oneida	16	90	29	54	70.7	5.78	12	84	16	50	64.7	7.05
Houseville	16	90	1	55	71.4	4.47	1	75	16	44	60.7	4.69
Depauville	17	88	1	57	71.2	3.01	12	80	16	48	61.7	5.30
Oswego	15, 16	88	1	53	70.9	2.33	12	80	23, 25	50	60.3	3.73
Palermo	16	94	1	56	72.0	2.80	12	83	23	45	69.1	4.10
Baldwinsville	15	87	1, 21	50	70.5	......	12	73	16	48	60.5	......
Skaneateles	15	93	1	52	70.2	......	......	......	......	......	......	......
Nichols	13	100	1	54	73.2	......	8, 18	84	17, 25	46	63.4	......
Geneva	16	94	1	56	73.8	2.07	12	80	16	51	62.9	3.22
Rochester	16	96	1	59	70.0	1.36	18	78	24	50	63.1	4.91
Rochester Univers'y	16	95	1	60	74.3	1.36	3, 12, 18	76	24	48	62.6	4.91
Little Genesee	14, 15	94	1	50	71.1	1.88	13	86	17	41	57.5	......
Buffalo	29	87	9	58	73.0	1.47	12	81	25	49	64.8	4.44
Averages	......	......	......	......	76.6	3.16	......	......	......	......	67.8	5.41

Meteorology of 1866—Continued.

Stations in States and Territories.	July. Date.	July. Maximum temperature.	July. Date.	July. Minimum temperature.	July. Mean temperature.	July. Rain or melted snow.	August. Date.	August. Maximum temperature.	August. Date.	August. Minimum temperature.	August. Mean temperature.	August. Rain or melted snow.
NEW JERSEY.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Paterson	17	99	1	52	75.0	4.85	1, 2	86	25	52	66.8	6.3[illegible]
Newark	17	99	1	54	76.1	1.84	1	86	25	49	67.3	5.3[illegible]
New Brunswick	17	101	11	61	76.7	2.91	1	87	25	53	67.1	7.0[illegible]
Trenton	17	99	2	64	81.7	4.26	2	86	24	57	72.7	4.5[illegible]
Burlington	17	97	1, 2, 11	62	75.9	2.90	2	84	25	52	67.6	3.9[illegible]
Moorestown	16	102	1	61	78.2	2.07	2, 8, 31	85	23	56	70.1	2.73
Mount Holly	17	98	2, 11	62	76.8	......	2	84	25, 26, 27	54	71.9	......
Seaville	18	99	1	60	79.4	2.60	......	......	......	......	......	......
Haddonfield	17	102	2	62	78.5	2.26	2	88	24	55	69.9	2.72
Greenwich	17	94	2	62	77.1	2.71	9	83	17	55	69.9	2.6[illegible]
Averages	......	......	......	......	77.5	2.93	......	......	......	......	69.2	4.67
PENNSYLVANIA.												
Nyces	14	97	1	47	74.2	2.30	31	87	25	40	62.6	3.1[illegible]
Fallsington	16, 17	98	2	63	77.0	2.80	2	84	26	55	69.0	4.5[illegible]
Philadelphia	17	100	21	65	80.7	2.51	1, 2	87	24	58	72.5	2.5[illegible]
Germantown	17	101	1, 21	63	79.1	......	1, 31	86	17	55	70.0	......
Horsham	16, 17	96	1, 10, 21	63	75.8	1.90	2	82	24, 25	53	67.3	5.2[illegible]
Dyberry	16, 17	96	1, 2	46	69.3	......	7	77	17, 21, 26	41	63.9	......
Nazareth	16	98	4	60	76.6	......	31	89	25	49	66.7	......
North Whitehall	16, 17	95	1, 2, 11	54	75.3	......	1	85	25, 26, 27	45	66.3	......
Parkesville	17	101	1, 11	64	79.5	1.44	2	88	27	54	71.3	3.1[illegible]
Stevensville	16	98	1	55	74.1	3.00	18	83	25	42	63.9	3.0[illegible]
Reading	......	......	......	......	......	......	3	88	26	49	68.5	......
Ephrata	16, 17	99	2	59	......	1.70	31	86	25	50	68.7	3.73
Silver Spring	16	100	1	58	77.6	......	31	86	25	52	68.0	......
Mount Joy	7, 16	94	17	58	73.9	1.43	1	85	27	52	68.4	3.70
Harrisburg	16	96	......	......	81.6	3.78	1	87	26	55	71.2	2.34
Lewisburg	16, 17	98	23	61	76.5	2.63	2	84	23	50	65.9	4.3[illegible]
Tioga	16	100	1	54	74.4	4.15	17	86	17, 24	44	64.1	4.2[illegible]
Pennsville	15, 16	94	1	44	72.4	5.25	31	82	17, 26, 27	42	62.[illegible]	5.6[illegible]
Connellsville	16	92	1	61	74.8	......	31	82	25	48	64.9	......
New Castle	16	94	1, 10	55	74.9	......	31	76	17	44	64.3	......
Canonsburg	16	95	1	58	74.9	3.71	18, 31	82	17	48	65.9	3.4[illegible]
Averages	......	......	......	......	75.9	2.81	......	......	......	......	66.9	3.78
MARYLAND.												
Woodlawn	17	97	2	63	75.1	2.90	2	86	23	55	70.1	3.00
Catonsville	16, 17, 18	93	10	60	76.6	......	2	82	25	51	67.5	......
Annapolis	17	97	1, 2	67	79.9	6.06	2, 9	86	17, 24	54	72.7	3.51
Frederick	17	96	1, 2	62	76.5	3.00	1, 2, 15	85	24, 25, 26	50	68.2	2.50
Averages	......	......	......	......	77.0	3.99	......	......	......	......	69.6	3.20
VIRGINIA.												
Wytheville	16	96	1	54	73.7	......	12	88	......	......	......	......
WEST VIRGINIA.												
Romney	6, 8, 14, 15	98	1	54	73.9	......	1	96	26	46	65.7	......
Cabell C. H.	15	91	2	62	76.1	6.70	1	85	27	51	69.2	3.10
Averages	......	......	......	......	75.0	6.70	......	......	......	......	67.5	3.10
NORTH CAROLINA.												
Statesville	17, 18	96	1	50	73.2	2.23	2	93	6	52	......	2.[illegible]
Wilson	8	101	31	71	82.1	6.64	9	96	24, 25	60	76.0	3.3[illegible]
Oxford	19	89	3	69	79.3	......	2, 4, 9	84	24	62	74.7	......
Raleigh	......	......	......	......	......	......	9	95	21, 24	59	75.0	1.50
Averages	......	......	......	......	78.2	4.44	......	......	......	......	75.2	2.2[illegible]

Meteorology of 1866—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
GEORGIA.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
tlanta	18, 19	92	1	50	75.8	1.27	8, 9	94	21, 24, 25, 26, 27	59	73.6	4.05
ALABAMA.												
oulton	22, 23, 24, 25	93	10	72	80.5	......	12	97	6	67	......	......
reen Springs	9	95	1	65	79.8	3.02	8	98	26	61	78.8	4.67
Averages	......	......	......	......	80.2	3.02	......	......	......	......	78.8	4.67
MISSISSIPPI.												
atchez	18	89	1	60	......	......	11	91	25	63	83.6	5.73
renada	27	91	1	55	......	......	8, 9, 12	92	25	58		
FLORIDA.												
ake City	......	......	......	......	......	......	10	95	17, 18, 27, 29	72	80.4	7.44
TEXAS.												
ustin	28, 29	96	14, 15	71	81.3	4.34	1	96	30	68	80.6	7.51
hapel Hill	28	96	1, 2	70	77.3	2.90	1	96	28	68	79.7	5.35
aufman	......	......	......	......	......	......	8	98	25	61	77.6	......
Averages	......	......	......	......	74.3	3.62	......	......	......	......	79.3	6.43
ARKANSAS.												
elena	26	98	2	65	81.6	3.20	8, 12	98	24	60	77.6	5.74
TENNESSEE.												
larksville	15	90	1	60	77.4	4.93	12, 13	93	25	51	72.2	0.68
ookout Mountain	19	102	2	71	83.5	......	8, 13	102	27	57	77.1	......
Averages	......	......	......	......	80.5	4.93	......	......	......	......	74.7	0.68
KENTUCKY.												
ouisville	15	93	1	53	77.4	8.37	12	91	24, 26	43	70.4	3.46
hilesburg	15	94	1	54	......	9.96	12	90	24	42	......	2.61
aylorsville	15	95	1	66	80.4	6.23	......	......	......	......	......	......
Averages	......	......	......	......	78.9	8.19	......	......	......	......	70.4	3.04
OHIO.												
ew Lisbon	16	98	1	61	75.6	4.10	13	88	23, 26	48	65.3	3.44
ast Fairfield	16	91	1	59	73.4	4.91	6, 31	74	24, 26	50	64.5	5.19
teubenville	16	95	1	60	79.7	4.00	31	79	26, 27	51	68.3	......
ilnersville	15, 16	96	10	55	73.8	3.90	18	83	27	44	64.6	3.28
ast Cleveland	16	95	9	58	74.7	3.53	13	85	17	49	65.4	3.76
leveland	......	......	......	......	......	......	3	80	17	49	69.2	......
ooster	14, 16	98	12	65	77.1	......	31	85	23, 26	50	66.7	......
allipolis	......	......	......	......	......	......	3	91	27	47	68.2	2.31
elley's Island	16	93	9	64	77.6	2.59	12	85	24	55	69.0	2.29
esterville	15	94	11	66	77.5	3.53	10, 18, 31	83	22, 25	51	66.5	2.54
ingston	15	100	9	64	77.6	1.84	30	88	25	50	68.2	2.85
oledo	16	95	11	61	74.6	4.00	13	81	24	51	65.2	2.44
arion	16	92	9	64	74.5	5.97	31	82	23, 25, 26	49	64.2	3.31
enton	16	97	4	60	78.1	8.63	31	89	24	50	67.7	14.85
rbana University	15, 16	91	1	63	75.5	4.74	18, 31	82	23, 25, 26	49	65.4	3.57
illsboro'	16	91	1, 10	61	77.2	5.33	12	80	24	48	66.2	2.87
ipley	16	100	31	68	85.7	......	......	......	......	......	......	......
ethel	15	93	1, 2, 3, 10	62	74.1	3.14	18	85	23	42	62.9	3.00
incinnati	16	92	9	66	78.0	6.82	8, 31	83	24	53	69.5	2.75
ollege Hill	15	96	10, 11	66	78.7	8.50	12	88	24	54	70.0	2.44
arm School	17	95	1	63	76.2	8.63	8	81	24	48	......	3.63
Averages	......	......	......	......	76.8	4.95	......	......	......	......	68.7	3.79

Meteorology of 1866—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MICHIGAN.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Monroe City	14	94	10	60	75.8	1.51	13	83	25	46	66.4	[illegible]
State Agricultural College.	14, 15, 16	90	9, 10	60	73.7	4.19	1	78	25	47	62.6	3.44
Litchfield	15	96	30	60	75.0	1.85	1, 13, 14	82	23	44	64.3	[illegible]
Grand Rapids	16	93	9	62	76.0	......	1, 10, 14	79	24, 25	49	63.9	......
Kalamazoo	......	......	......	......	......	......	18	94	22, 23, 24, 25	60	74.6	......
Northport	5	94	8	55	71.1	......	14, 17	77	22, 24	48	62.0	....
Holland	15	94	9	50	74.0	2.07	31	83	21	43	62.8	[illegible]
Houghton	......	......	......	......	......	......	16	85	23	48	62.9	[illegible]
Ontonagon	11	90	9	50	67.5	......	16	78	21, 29	48	59.6	......
Homestead	14	92	8	56	73.5	......	1	76	22	42	60.8	......
Averages	......	......	......	......	73.3	2.41	......	......	......	......	64.0	[illegible]
INDIANA.												
Richmond	15, 16	91	1	62	75.0	5.64	10	81	23	47	65.0	[illegible]
Aurora	15	101	10	62	81.5	4.96	11	92	24	50	71.7	[illegible]
Vevay	14, 15	100	1	67	84.7	6.95	12	96	26	50	75.9	1.47
Muncie	......	......	......	......	......	......	1	85	23, 25	49	67.2	[illegible]
Spiceland	15	90	1	63	76.6	9.10	10	85	23	48	66.2	4.60
Madison	15	94	1	66	82.5	6.93	......	......	......	......	......	......
Columbia City	15	99	1	57	76.3	4.32	14	88	24	45	65.9	[illegible]
Indianapolis	......	......	......	......	......	......	31	88	23	49	69.3	......
New Harmony	15	95	1	68	82.0	3.11	12	96	25	56	74.1	[illegible]
Averages	......	......	......	......	79.8	5.86	......	......	......	......	69.4	[illegible]
ILLINOIS.												
Chicago	13, 14, 15, 16	104	9	60	78.6	......	14	92	22, 24	50	70.6	......
Marengo	3	99	8	58	75.1	5.19	12	86	22	45	64.5	[illegible]
Riley	15	96	9	57	72.9	4.23	......	......	......	......	......	......
Golconda	15	102	1	57	83.3	3.32	12	100	24	40	77.7	[illegible]
Aurora	16	96	1, 9	60	76.2	3.21	12	85	24	48	68.2	[illegible]
Sandwich	14, 16	96	9	61	76.1	3.89	10	86	22	46	64.8	[illegible]
Ottawa	13	99	18	62	76.0	......	30	90	24	50	65.1	[illegible]
Winnebago	13	95	9	59	75.6	5.03	12	83	29	46	65.1	[illegible]
Hennepin	13, 16, 17	95	9	53	......	......	......	......	......	......	......	......
Wyanet	12	96	9	59	76.3	4.19	12	89	22	52	68.8	3.44
Tiskilwa	12, 13, 14	99	19	58	78.1	......	12	91	23	48	69.5	......
Elmira	15	95	1, 9	60	77.1	4.57	12	86	25	48	68.0	[illegible]
Rochelle	13, 15	96	9	58	73.0	......	12	90	23, 24	50	66.5	......
Peoria	15	95	9	62	78.2	5.17	12	90	23	50	70.1	3.97
Springfield	15	98	1	62	77.7	......	12	96	24	51	71.2	......
Loami	15	97	19	68	78.3	4.23	12	100	25	51	70.6	[illegible]
Dubois	16	98	3	54	75.4	3.65	12	94	24	38	66.1	[illegible]
Galesburg	13	93	1	60	75.6	4.28	3, 12	85	23	50	67.5	[illegible]
Manchester	16	96	19	60	79.9	4.02	12	101	23	52	72.6	[illegible]
Mt. Sterling	15	97	19	64	82.0	......	12	94	22	50	73.0	......
Andalusia	13, 18	99	1	65	82.9	......	3, 4	88	23	50	71.1	......
Augusta	13, 14, 15, 16, 17, 22, 23, 27	89	9	65	79.3	3.20	12	91	23	50	72.2	[illegible]
Averages	......	......	......	......	77.5	4.16	......	......	......	......	69.2	4.20
WISCONSIN.												
Manitowoc	13, 15	96	9	54	71.4	2.58	12	83	24	46	63.0	[illegible]
Plymouth	12, 13	96	8, 9	54	74.0	4.60	12	84	22, 23, 24	48	63.4	[illegible]
Milwaukee	13	96	8	55	73.2	3.54	12	85	24	49	63.1	[illegible]
Ripon	15	95	9, 16	61	74.1	......	10, 14, 17	80	22	47	63.1	......
Geneva	13, 14, 17	93	9	58	75.4	......	12, 14	82	25	50	65.0	......
Delavan	16	98	8, 9	56	74.7	3.35	......	......	......	......	......	......
Waupacca	13	96	9, 10	60	77.5	......	1, 10, 12, 14	80	24	48	65.6	......

Meteorology of 1866—Continued.

Stations in States and Territories.	JULY. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	AUGUST. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
WISCONSIN—Con'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Weyauwega	14	94	9	58	75.7	0.70	14	81	23	48	63.1	3.60
Embarrass	13	104	9	54	74.6	3.24	2, 26	84	16	46	62.5	5.34
Rocky Run	12, 13, 14, 15	92	9	60	78.8	4.75	12	84	23	48	61.5	8.00
Beloit	16	93	1, 10	60	75.4	5.53	14	81	22	48	67.7	8.67
Baraboo	12, 13	96	9	54	76.0	......	10	85	21	52	......	13.44
Averages	......	......	......	......	75.1	3.54	......	......	......	......	64.0	6.57
MINNESOTA.												
Beaver Bay	12, 15	90	6, 8	50	67.3	3.94	14	84	21, 24	46	63.2	2.10
Afton	12, 13	94	3	59	75.0	......	2, 9, 15, 16	82	23	42	64.7	......
St. Paul	12	90	8	59	73.7	2.30	10	80	23	45	62.4	4.73
Minneapolis	13, 15	98	8	63	78.5	2.27	2	85	22	46	70.1	4.90
Sibley	12	98	8	58	74.6	2.29	17	88	23, 24	42	63.4	16.20
New Ulm	12, 15	97	2, 6, 17, 18	64	79.7	3.05	17	88	22, 23, 24	50	68.9	6.34
Averages	......	......	......	......	74.8	2.77	......	......	......	......	65.5	6.85
IOWA.												
Clinton	12, 13	96	1, 2, 10	62	78.7	6.20	12	88	25	50	68.1	7.25
Lyons	13	94	2, 10	63	77.8	6.06	1	86	22	49	68.2	9.45
Davenport	12, 13, 15, 17, 21	90	1, 2, 10, 19	64	75.5	3.33	3	84	23, 25	52	68.0	13.33
Dubuque	13	96	1	61	76.5	5.04	14	82	23	50	66.5	8.26
Muscatine	13	94	10	59	71.8	5.18	......	......	......	......	......	......
Monticello	13	94	1, 8, 19	62	73.3	5.63	17	84	23, 25	50	66.8	8.20
Fort Madison	23	96	1	62	80.2	6.76	12	95	23, 25	48	71.0	2.63
Guttenberg	12, 16, 29	94	19	54	73.6	......	9, 10, 12, 13, 14	83	22	42	64.4	......
Ceres	12	96	1, 2, 4	60	76.8	......	9	86	23	50	67.3	......
Manchester	12, 13, 16	90	2	58	72.8	6.51	14	82	25	38	61.6	4.79
Mount Vernon	17	93	9	58	76.1	......	3	83	23, 24	49	66.3	......
Iowa City	12, 15, 21, 28	94	3	58	77.1	4.55	14	88	25	43	68.8	6.85
Independence	13	100	2, 8	57	77.8	7.30	15	87	24	44	66.5	13.60
Waterloo	12	94	2, 8	58	86.7	......	12	86	24, 25	40	65.8	......
Osage	12	96	2, 17, 18, 19	61	77.1	......	17	86	25	43	66.2	......
Iowa Falls	12, 13, 14, 22	92	2	59	74.3	......	11	82	24, 25	42	68.2	6.91
Des Moines	22	94	2	48	72.6	......	6	94	23, 24	49	69.7	2.13
Fontanelle	22	94	2	60	77.2	2.90	3	94	23	49	70.2	2.75
Harris Grove	22	99	9	53	76.5	3.00	6	94	24	46	70.1	1.30
Averages	......	......	......	......	76.4	5.21	......	......	......	......	67.4	6.73
MISSOURI.												
St. Louis	22, 26, 27	97	9	65	81.7	3.68	12	100	25	54	74.5	5.16
St. Louis Univer'ty.	26, 27	95	9	65	81.8	3.65	12	97	23	58	75.9	3.71
Allenton	26, 27, 29, 30	95	2	61	75.7	4.93	11	97	24, 25	42	68.9	3.53
Union	27	98	1	68	80.6	5.64	12	102	25	50	73.5	1.46
Athens	23	103	11	67	82.7	3.69	......	......	......	......	......	......
Canton	26	101	18	64	80.9	5.67	7, 11, 12	100	24	38	72.1	2.13
Rolla	27, 28	92	2	60	76.5	6.36	12	98	25	42	70.3	1.50
Harrisonville	18	96	2	62	74.8	7.88	3, 6, 7, 12, 31	92	24	52	73.5	4.00
Easton	23, 25, 27, 28	92	8	62	79.7	4.69	7	93	24	58	75.0	0.80
Averages	......	......	......	......	79.4	5.13	......	......	......	......	73.0	2.79
KANSAS.												
Leavenworth	21	98	8	61	77.2	9.31	12	100	24	41	72.2	1.15
Olathe	12	100	8	63	78.6	9.80	12	97	23	51	74.0	......
State Agr. College.	24, 26, 27	96	8	64	......	3.27	7, 11, 31	98	23	55	72.8	0.10
Council Grove	27	100	8	60	75.8	3.15	7	102	24	48	75.3	2.05
Averages	......	......	......	......	77.2	6.38	......	......	......	......	73.6	1.10

Meteorology of 1866—Continued.

Stations in States and Territories.	JULY.						AUGUST.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
NEBRASKA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Elkhorn	22	102	2	60	78.4	......	7	101	24	50	72.2	......
Bellevue	21	99	2	60	79.0	1.52	3	95	23	51	73.2	1.46
Glendale	22	97	2	60	77.8	2.80	6	101	22	45	72.3	3.22
Averages	......	......	......	......	78.4	2.16	......	......	......	......	72.6	2.34
UTAH TERRITORY.												
Great Salt Lake City	9, 20	90	7	64	......	8.73	2	88	3, 9, 11, 31	60	83.5	......
Wanship	8	94	31	47	71.2	......	17	97	8, 30	48	66.7	......
Averages	......	......	......	......	71.2	8.73	......	......	......	......	75.1	......
CALIFORNIA.												
San Francisco	10, 12, 26	65	31	51	56.3	0.00	13	71	8, 9, 10	51	56.5	0.00
Sacramento	1	98	5, 8, 11	64	75.9	0.02	15, 16	98	29	60	76.0	[illegible]
Monterey	18	78	9	52	59.3	0.00	14	75	1, 26	54	61.0	[illegible]
Averages	......	......	......	......	63.8	0.01	......	......	......	......	64.5	0.00
OREGON.												
Corvallis	3	98	11, 25	50	......	......	14	92	4	46	......	......
MONTANA TERRI'Y.												
Helena City	20, 23, 28	96	31	66	78.9	0.07	21	96	6	65	77.9	0.90
WASHINGTON TER.												
Neeah Bay	1	74	26	49	57.0	0.60	6	66	25, 31	48	56.0	2.40

Stations in States and Territories.	SEPTEMBER.						OCTOBER.					
MAINE.												
Steuben	3, 7	73	24	40	57.9	8.15	8	70	29	26	44.5	2.00
Barnard	3	76	23	38	55.0	7.35	2, 8, 20	66	26	20	44.3	3.17
West Waterville	3	80	23	38	59.7	5.20	8	72	26	22	48.1	4.95
Gardiner	3	77	23	40	59.0	5.66	8	70	26	26	47.4	2.59
Lisbon	......	......	22	30	......	5.26	......	......	......	......	......	4.10
Webster	3	81	23	36	56.4	......	8, 20	70	26	24	45.7	......
Rumford Point	......	......	......	......	......	......	8, 21	70	26	18	46.1	2.65
Cornish	3	82	23	34	59.0	5.18	8	76	5, 26	26	47.3	2.54
Cornishville	3	82	23	41	60.5	5.75	8	74	26, 29	28	48.6	2.50
Averages	......	......	......	......	58.5	6.08	......	......	......	......	46.5	2.98
NEW HAMPSHIRE.												
Stratford	5	74	16	30	54.7	6.78	21	72	26	20	43.1	3.97
Shelburne	3	82	24	36	58.2	......	8	75	26	21	46.8	......
North Barnard	3	83	16	34	......	5.00	8	75	31	26	50.3	2.94
Concord	12	81	23, 24	37	58.9	3.06	8	75	25	29	48.7	2.03
Claremont	3	82	16, 23, 24	34	59.5	7.18	8	75	6, 26	26	48.0	3.30
Averages	......	......	......	......	57.8	5.51	......	......	......	......	47.4	3.06
VERMONT.												
Lunenburg	5	90	23, 24	28	51.5	6.00	16	81	4	16	48.8	1.85
Craftsbury	2	75	23	34	53.8	7.22	2, 21	72	25, 26	23	44.8	2.00
Randolph	2	81	16	31	58.2	5.12	8	74	5, 6	21	46.7	2.34
Middlebury	2	76	23	36	57.5	4.93	21	70	6, 25, 26	30	48.5	2.30
Brandon	5	88	23	39	59.2	5.20	3, 8	80	25	26	50.1	2.48
Wilmington	1	84	23	29	57.7	......	20	73	25	20	46.3	......
Averages	......	......	......	......	56.3	5.69	......	......	......	......	47.5	2.21

Meteorology of 1866—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MASSACHUSETTS.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Kingston	8	86	16, 23	44	64.1	5.80	8	80	26	32	52.0	3.21
Topsfield	3	85	23, 24	44	60.4	4.73	8	75	5, 28	35	48.6	2.28
Lawrence	1	85	24	39	56.0	4.76	8	73	6	29	48.6	1.79
Georgetown	......	......	......	......	......	......	8	76	26	31	49.2	......
Newbury	3	88	23	40	61.0	......	8	75	25	30	48.9	......
North Billerica	2	87	24, 28	37	61.8	......	8	78	5, 6	28	49.2	......
New Bedford	3	79	16	43	63.6	5.20	8	75	26	30	51.5	2.52
Worcester	3	83	24	42	62.4	4.77	8	73	26	32	51.0	2.37
Mendon	3	83	24	40	61.4	5.80	2	72	5	29	49.6	2.90
Lunenburg	3	84	16	40	61.4	......	8, 20	75	5	29	50.2	......
Amherst	3	83	16, 23, 24	36	60.0	4.71	8	73	5	27	49.5	3.38
Springfield	3	92	24	35	62.2	5.21	7, 8	79	26	27	51.0	2.76
Richmond	5	87	10	38	64.9	7.02	......	......	......	......	......	......
Williams College	2	80	23	36	58.5	4.97	21	74	6	28	45.7	2.37
Averages	......	......	......	......	61.4	5.30	......	......	......	......	49.6	2.62
RHODE ISLAND.												
Newport	3, 7	81	23	42	62.4	5.02	17	77	26	27	50.6	2.34
CONNECTICUT.												
Pomfret	3	80	16	40	60.4	5.71	8	72	26	28	49.6	3.13
Columbia	3	88	24	38	63.6	......	8, 20, 21	76	5	32	52.7	......
Middletown	3	89	16	40	64.2	6.74	8	76	26	28	51.5	2.98
Colebrook	3	84	16, 23	38	57.4	......	20	74	25, 26	28	49.5	......
Groton	3	86	16	45	64.2	4.06	8	78	26	30	51.2	3.91
Averages	......	......	......	......	62.0	5.50	......	......	......	......	50.9	3.34
NEW YORK.												
Moriches	3	90	29	50	69.6	5.50	8	83	6	39	57.4	4.14
South Hartford	4	86	24	37	62.5	5.28	21	79	5	27	52.2	1.07
Germantown	3	89	16, 23, 24	42	62.0	6.50	1, 20	78	5	32	52.6	3.50
Fishkill	2	85	23	41	61.6	......	8	73	5, 26	33	52.5	3.03
Garrison's	3	82	23	42	60.8	5.14	8	72	26	32	50.9	5.84
Throg's Neck	2, 3	84	10, 22, 23	50	66.0	......	2, 8	82	5	36	55.4	......
White Plains	3	82	16	43	63.1	......	1	72	5	32	52.7	......
Deaf and Dumb In.	1, 2, 3	82	23, 24	46	65.3	4.85	8, 22	71	5	37	54.1	5.28
St. Xavier's College	2	85	23	48	67.0	3.15	8	74	26	36	54.5	4.66
Columbia College	2	83	23	51	66.8	2.97	8	72	26	35	54.6	1.70
Flatbush	3	84	24	46	62.6	3.86	1	81	26	34	57.0	3.49
Newburgh	5	85	16, 23, 29	49	63.4	3.29	1, 8, 20	74	26	36	54.8	2.19
Gouverneur	1	81	23	34	56.0	6.02	21	76	25	24	47.3	2.61
North Hammond	1	80	23	34	55.9	10.44	8	75	5	24	49.2	4.14
South Trenton	1	84	23	34	63.8	8.07	20	74	5, 6	22	49.0	2.76
Oneida	1	90	16	40	62.5	9.08	21	80	25	28	53.2	3.08
Houseville	1	81	23	36	56.4	7.92	8	72	5	26	46.8	3.23
Depauville	1	82	16	39	57.0	6.42	19	74	25	30	50.0	3.44
Theresa	......	......	......	......	......	5.58	......	......	......	......	......	3.01
Oswego	2	83	23	40	57.0	5.31	21	74	26	33	51.4	3.77
Palermo	1	85	22, 23	37	56.2	7.30	21	77	5	22	48.5	4.30
Baldwinsville	2	78	23	38	56.4	......	21, 22	72	25	31	49.1	......
Skaneateles	......	......	23	34	55.8	......	8	71	5, 25	26	47.9	......
Nichols	1	88	23	39	58.7	......	8, 20	78	6	29	50.2	......
Geneva	2	85	23	43	59.4	4.58	20, 21, 22	78	5	30	54.7	1.83
Rochester	2	83	23	40	58.7	4.11	21	76	5	31	52.0	1.22
Rochester Univer'y	2	81	23	36	57.8	4.11	20	77	5	29	51.0	1.24
Little Genesee	2, 4	80	23	30	56.7	3.40	21	77	5, 6	25	48.1	2.25
Buffalo	4	86	22	39	58.7	7.75	1	80	5	28	52.5	2.41
Averages	......	......	......	......	60.6	5.68	......	......	......	......	51.8	3.09
NEW JERSEY.												
Paterson	2	87	23	43	65.2	7.31	8	76	5, 6	33	55.1	5.35
Newark	3	84	16	43	65.2	5.47	8	74	6	33	54.2	3.97

Meteorology of 1866—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
NEW JERSEY—Con.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
New Brunswick	3	84	16	47	65.6	5.84	8	76	26	32	54.1	3.[illegible]
Trenton	3	87	23	49	69.9	7.88	22	72	26	38	57.1	4.[illegible]
Burlington	3	86	23	46	65.7	8.00	21	74	26	32	54.8	4.5
Moorestown	3	91	23	47	67.3	6.21	8	77	26	34	54.8	4.4[illegible]
Mount Holly	3	86	16, 23	48	66.9	......	22	73	6, 26	35	55.2	......
Seaville	......	......	......	......	......	......	8	86	5, 25, 26	36	54.6	6.[illegible]
Dover	......	......	29	53	......	......	8	75	26	36	56.5	......
Haddonfield	3	90	16	47	67.7	5.93	8	76	26	34	54.6	2.[illegible]
Greenwich	3	86	16	48	68.3	7.06	8	73	26	36	55.6	3.9[illegible]
Averages	......	......	......	......	66.9	6.71	......	......	......	......	55.1	4.4[illegible]
PENNSYLVANIA.												
Nyces	3	86	23, 28	38	58.9	3.10	20	79	5	18	49.4	2.[illegible]
Fallsington	1	85	16, 23	49	66.7	6.50	21	75	26	36	54.7	[illegible]
Philadelphia	3	90	16, 23	51	69.7	7.46	8	75	5	38	56.8	[illegible]
Germantown	3	93	22	45	66.9	......	2	79	6, 26	33	54.6	......
Horsham	3	86	16	45	65.2	8.32	8, 21	73	26	32	53.7	4.[illegible]
Dyberry	1	82	23	31	58.0	......	8	78	5	25	47.9	......
Nazareth	3	94	27	56	65.5	......	8	72	5	26	......	......
North Whitehall	3	83	16	37	64.0	......	8	74	6	25	53.1	......
Parkesville	3	93	16, 22, 23	50	67.6	7.45	8	75	6	34	54.5	2.[illegible]
Stevensville	1	88	23	32	60.5	4.33	8, 21	79	5	22	50.1	2.[illegible]
Reading	3	88	16, 23	45	65.6	......	1	73	5	34	54.3	......
Ephrata	3	92	16	46	66.6	4.47	21	80	26	34	56.4	1.[illegible]
Mount Joy	6	88	23	44	67.0	4.00	20	80	6	39	55.8	......
Harrisburg	1	87	23	48	68.9	4.39	1	75	26	39	57.1	[illegible]
Lewisburg	1	86	23	39	62.1	5.18	8	75	6	31	51.7	4.[illegible]
Tioga	1	90	22, 23	38	61.0	6.75	8, 9	80	6	24	51.5	2.[illegible]
Pennsville	12	83	22	38	59.5	5.67	2	77	5	24	48.7	4.[illegible]
Connellsville	1	86	22	40	62.8	......	21	77	25	28	51.3	......
New Castle	1	83	22	37	61.3	......	1	75	5, 27	34	54.4	......
Canonsburg	1	88	22	35	62.8	5.85	8	82	25	28	51.9	4.[illegible]
Averages	......	......	......	......	64.0	5.65	......	......	......	......	53.1	3.[illegible]
MARYLAND.												
Woodlawn	3	88	27	48	67.5	8.98	8	80	31	36	56.2	4.[illegible]
Catonsville	1, 3, 19	84	22, 27	46	64.6	......	1, 20, 21	68	5, 25	36	55.6	......
Annapolis	19	88	27	49	65.6	10.63	3, 8, 9, 22	74	31	40	58.1	[illegible]
Frederick	3, 4	86	23	44	64.7	6.00	......	......	......	......	......	......
Averages	......	......	......	......	65.6	8.54	......	......	......	......	56.6	6.[illegible]
VIRGINIA.												
Lynchburg	......	......	......	......	......	......	17	76	26	41	53.1	......
WEST VIRGINIA.												
Romney	4, 5, 18	88	23	40	62.1	......	7, 8, 19, 20, 21.	82	31	30	......	......
NORTH CAROLINA.												
Statesville	3, 4	90	22	44	67.4	7.25	3	80	25	26	56.1	4.[illegible]
Wilson	3	94	22	54	74.1	4.94	3, 22	78	25, 26, 31	42	60.2	2.[illegible]
Oxford	5	83	23	56	69.4	......	2	71	24	42	56.5	......
Raleigh	3	92	23	52	72.1	5.50	3	79	25	35	56.6	5.[illegible]
Averages	......	......	......	......	70.8	5.90	......	......	......	......	57.4	4.[illegible]
ALABAMA.												
Moulton	2	87	22	47	......	......	2, 9	76	25	33	......	......
Green Springs	2	92	22	50	73.4	4.79	3	83	25	35	61.6	1.[illegible]

Meteorology of 1866—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
FLORIDA.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Jacksonville	9	98	18	70	82.3	......	......	......	......	......	......	......
Gordon	5	94	29	68	78.7	......	3	89	31	50	71.0	......
Lake City	20	90	29	65	83.3	13.25	4	88	25	48	69.7	3.50
Averages	......	......	......	......	81.4	13.25	......	......	......	......	70.4	3.50
TEXAS.												
Austin	2, 3, 4, 5, 6	91	21	55	75.4	4.84	10	87	22	47	69.2	0.38
Kaufman	5	92	26	49	73.9	......	19	87	22	39	67.1	......
Averages	......	......	......	......	74.7	4.84	......	......	......	......	68.2	0.38
MISSISSIPPI.												
Natchez	3	88	22	45	74.6	3.20	5	78	25, 31	44	65.2	2.00
Kingston	......	......	......	......	......	......	20	81	31	46	65.2	......
Grenada	4	90	22	[illegible]	......	......	4, 9	80	24	35	......	......
Averages	......	......	......	......	74.6	3.20	......	......	......	......	65.2	2.00
ARKANSAS.												
Helena City	4	97	22	46	74.2	9.16	13, 19	78	31	33	60.0	4.69
TENNESSEE.												
Clarksville	4	91	22	44	68.0	5.60	2, 20	78	25	32	58.1	2.24
Lookout Mountain	4	100	21	46	69.1	......	1, 2, 3, 18	75	31	30	58.8	......
Tusculum College	......	......	......	......	......	......	19	74	25	26	52.9	......
Averages	......	......	......	......	68.6	5.60	......	......	......	......	56.6	2.24
KENTUCKY.												
Louisville	2	87	2	39	66.8	12.80	20	85	25	28	57.9	1.72
Chilesburg	1, 3, 4	84	2	40	......	5.31	2, 20, 28	78	25	28	......	2.88
Danville	4	90	22	45	66.8	5.08	1, 7, 9, 20	78	25	32	57.6	2.48
Averages	......	......	......	......	66.8	7.73	......	......	......	......	57.8	2.36
OHIO.												
New Lisbon	5, 6	85	27	38	63.8	7.68	2, 7	80	25, 27	32	51.7	2.20
East Fairfield	1	80	22	40	59.9	10.19	20	70	25, 27, 31	34	52.0	2.91
Steubenville	1	80	22	42	64.5	7.50	19	74	25, 31	36	53.5	......
Milnersville	25	82	27	38	60.3	8.02	20	76	31	26	49.4	2.40
East Cleveland	1	85	22	42	60.6	7.91	20	76	31	33	52.8	3.54
Gallipolis	1	83	22	44	64.6	8.40	21	83	31	32	55.0	2.07
Kelley's Island	1	85	21	48	63.0	7.15	8	75	31	38	56.2	1.84
Norwalk	1	84	22	40	59.2	7.06	2	78	31	32	52.7	2.27
Westerville	2	83	22	40	63.0	13.90	1	76	25	31	53.6	2.74
Kingston	2	85	22	41	63.6	6.49	1, 2, 8	78	25	33	54.1	1.88
Toledo	1	84	22	37	59.0	7.19	8	78	31	32	53.1	2.63
Marion	1	82	22	41	59.4	11.35	2	76	25	32	51.9	2.61
Kenton	2	94	23	56	64.2	15.30	7	79	24, 30, 31	40	57.5	3.31
Urbana University	2	82	22	36	61.8	15.88	2, 8, 20	75	25	29	53.7	2.41
Hillsboro'	2	79	22	40	62.1	9.59	20	73	24	32	53.8	2.79
Bethel	2	81	22	38	59.0	8.00	2	82	25	28	50.5	2.38
Cincinnati	2	82	22	43	64.8	10.55	29	75	24, 27, 31	33	55.8	1.85
College Hill	2	83	30	50	......	12.00	2	80	25	32	54.8	......
Farm School	2	78	23	40	......	12.50	20	74	26	32	54.7	2.63
Averages	......	......	......	......	61.9	9.82	......	......	......	......	53.5	2.49

Meteorology of 1866—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MICHIGAN.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Monroe City	1	82	22	40	58.6	4.61	2, 7, 8, 21	72	31	33	54.0	2.94
State Agr. College	6	76	22, 26	36	55.5	5.81	2, 18	73	5, 31	32	49.5	3.57
Litchfield	3, 9	78	21, 22	35	57.4	10.42	2	77	24	28	49.0	7.87
Grand Rapids	3	77	26	38	60.0	......	1	76	31	30	50.4	......
Kalamazoo	3	92	25	48	69.0	......	......	......	......	......	......	......
Northport	4, 28	74	22	42	56.4	......	1	78	31	28	49.7	......
Holland	3	76	26	35	56.6	7.85	18	77	31	31	50.4	4.56
Ontonagon	28	84	20	36	53.9	......	7	82	31	30	47.7	......
Homestead	29	75	26	36	54.3	......	7	75	31	32	48.7	......
Averages	......	......	......	......	65.2	9.56	......	......	......	......	57.1	6.31
INDIANA.												
Richmond	2	81	21, 22	42	60.3	18.40	2	74	25	28	52.8	2.54
Aurora	2	90	22	42	65.8	10.74	2	81	25	26	......	1.52
Vevay	2	90	21, 22	46	68.9	15.25	2	82	25	32	58.9	1.48
Muncie	1	84	22	40	61.0	11.72	2, 7, 8	77	24, 31	32	53.6	3.00
Spiceland	1, 2, 16	80	22	42	61.6	16.30	2, 7	78	24, 25, 31	31	53.5	1.70
Columbia City	16	84	22	36	59.1	6.19	1, 2, 7	76	25	30	52.1	......
Indianapolis	2	86	22	41	61.9	......	2	80	24, 25, 31	29	53.3	2.01
Merom	......	......	......	......	......	......	2, 7	77	25, 31	32	56.0	2.74
New Harmony	4	87	22	45	66.3	10.74	20	77	25, 31	35	56.7	0.98
Averages	......	......	......	......	63.1	12.76	......	......	......	......	54.6	2.00
ILLINOIS.												
Chicago	2, 4	82	21	38	61.9	......	6, 7	80	24	29	54.3	......
Riley	2	75	23	46	......	7.18	7	75	31	22	49.8	2.72
Golconda	1	92	22	39	71.9	7.83	7	91	27	29	65.2	0.57
Aurora	1, 3, 4	76	21	37	57.9	4.80	1	76	31	24	50.0	2.40
Sandwich	3	80	21, 22	32	58.9	2.94	1, 6, 7	75	31	23	50.9	3.23
Ottawa	1	82	22	37	59.7	4.72	7	80	31	26	52.9	2.16
Winnebago	2, 3, 4, 29	77	21	37	57.3	4.19	1	77	31	21	49.5	2.86
Rochelle	4	83	21	40	59.1	......	4	86	31	22	52.0	......
Wyanet	30	88	21, 22	40	60.3	6.81	1	86	31	26	53.3	1.66
Tiskilwa	3	80	22	36	58.2	......	6	73	31	24	51.5	......
Elmira	1, 3, 29, 30	76	21	34	57.4	8.25	1	76	31	23	51.8	2.00
Peoria	2	79	21	39	60.2	6.50	1	75	31	29	54.6	2.87
Springfield	2	93	21, 22	42	61.0	......	2	82	31	34	55.2	......
Loami	4	81	20	40	60.2	6.55	8	78	31	25	53.6	4.50
Dubois	2	83	21	28	53.6	10.15	6	80	31	24	50.7	3.25
Galesburg	1, 2, 3, 30	76	22	34	......	8.38	1	76	31	25	51.0	2.00
Manchester	28	87	21	38	61.3	7.08	17	80	31	26	56.0	5.98
Mount Sterling	1	84	21	39	61.2	......	1	77	31	26	55.9	......
Andalusia	10	81	21	38	46.4	......	......	......	......	......	......	......
Augusta	1	77	21	38	61.7	10.30	1	74	31	27	56.0	3.83
Averages	......	......	......	......	59.3	6.84	......	......	......	......	53.4	2.89
WISCONSIN.												
Manitowoc	5	75	15	40	57.1	1.27	1	80	31	28	49.6	2.33
Plymouth	29	82	22	35	56.1	1.90	1	81	24	27	49.3	4.10
Milwaukee	1	74	21	38	59.0	5.67	1	78	31	28	51.3	3.39
Geneva	3	77	20	35	57.8	......	7	76	31	26	50.7	......
Delavan	1, 29	75	16	33	55.8	3.96	1	76	31	24	49.5	2.05
Waupacca	29	83	15, 21	38	57.4	......	1	83	31	25	50.3	......
Embarrass	29	86	21	35	58.3	1.21	1	84	24	24	48.9	3.17
Rocky Run*	3	77	20	35	......	......	1	80	31	22	49.5	2.25
Beloit	28	75	21	33	55.9	1.88	1	75	31	23	49.9	1.41
Baraboo	29	86	21	40	......	2.60	1	84	31	24	50.7	4.00
Averages	......	......	......	......	57.2	2.64	......	......	......	......	50.0	2.81

Meteorology of 1866—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MINNESOTA.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Beaver Bay	2	74	21	36	53.6	4.13	1	80	31	18	41.8	1.81
St. Paul	28	78	21	30	53.9	2.26	6	83	31	18	49.0	2.67
Minneapolis	28	86	21	32	56.1	2.22	1	86	31	18	49.2	1.94
Sibley	......	......	......	......	......	......	1	86	31	16	47.8	3.00
New Ulm	28	87	21	31	58.2	2.02	1, 6	86	31	19	51.8	0.66
Averages	......	......	......	......	55.5	2.66	......	......	......	......	47.9	2.02
IOWA.												
Clinton	29, 30	80	21, 23	36	57.1	10.00	1, 6, 7, 9, 10, 14, 16	80	30	28	52.4	3.10
Davenport	30	75	20	42	56.5	7.05	1, 18	75	31	26	52.3	1.78
Dubuque	29	78	21	34	57.6	3.55	1	79	31	22	51.2	2.40
Monticello	30	82	21	34	54.8	3.73	1	80	31	20	50.8	3.21
Fort Madison	3	81	21	32	59.6	7.32	1	76	31	21	53.1	2.51
Keokuk	29, 30	78	21	34	......	6.40	28	78	31	23	52.2	4.15
Guttenberg	30	84	21, 26	34	55.7	......	1	84	31	18	48.8	......
Ceros	29	80	21	36	57.6	......	6, 12	78	31	20	51.2	......
Manchester	30	82	21	36	54.8	2.58	1	82	31	17	47.7	2.49
Mount Vernon	30	79	21	33	57.7	......	1	80	31	20	51.5	......
Iowa City	28	81	21	33	59.1	6.53	1	82	31	20	53.1	4.67
Independence	28, 30	82	19	33	53.8	3.70	1	82	31	18	51.4	2.70
Waterloo	29, 30	80	14, 15	40	57.3	......	1, 6	80	30, 31	28	53.0	......
Osage	8	79	20	40	56.2	......	1	83	31	18	49.0	......
Iowa Falls	29, 30	76	21	30	58.7	6.50	3	74	31	19	50.8	1.17
Des Moines	30	81	21	35	57.9	4.25	6	81	30, 31	26	51.5	0.50
Algona	27, 28	82	20	34	55.4	......	1, 6	84	31	18	50.0	......
Fontanelle	27, 29	82	21	33	57.4	6.50	1, 6	81	31	18	52.5	1.88
Harris Grove	27	82	20	33	57.1	4.40	12	83	31	20	55.0	......
Averages	......	......	......	......	57.2	5.58	......	......	......	......	51.4	2.55
MISSOURI.												
St. Louis	2	88	21	42	63.3	10.53	20	80	31	31	57.7	2.01
St. Louis Univer'ty	2	84	21	43	63.6	8.28	20	79	31	33	58.4	2.38
Allenton	2	89	22	32	59.3	8.90	2	78	31	23	52.8	2.92
Union	2	89	21, 22	40	62.3	7.20	2	80	31	27	55.7	2.40
Rolla	2	88	21, 23	36	61.5	13.80	4, 5, 9, 12	84	24, 31	26	55.6	2.18
Harrisonville	1	86	21	34	61.1	7.72	1, 2, 7, 10, 12, 13	80	31	26	57.2	7.78
Easton	27, 28, 30	84	18, 20, 22	40	60.1	11.54	1, 5, 13	84	31	24	54.8	2.47
Averages	......	......	......	......	61.6	9.71	......	......	......	......	56.0	3.16
KANSAS.												
Leavenworth	1	86	21	29	59.5	7.09	5	83	31	19	53.8	1.55
Olathe	1	90	21	30	60.7	11.56	2, 4, 5, 11	80	31	21	55.2	3.90
State Agr. College	1	90	20, 21	42	62.3	6.23	13	88	23, 31	30	57.8	0.43
Council Grove	1	88	20	42	63.3	4.55	12, 13	86	31	28	56.4	2.53
Averages	......	......	......	......	61.5	7.36	......	......	......	......	55.8	2.10
NEBRASKA.												
Elkhorn	30	83	21	40	58.2	......	12	84	24, 30	24	54.1	......
Bellevue	1	80	21	36	59.6	5.90	1	80	31	23	48.2	0.34
Glendale	27	85	20	32	57.3	5.65	12	86	24	14	53.1	0.00
Averages	......	......	......	......	58.4	5.78	......	......	......	......	51.8	0.17
UTAH TERRITORY.												
Great Salt Lake City	14, 30	82	24	40	65.0	2.05	2, 3	82	20	32	55.6	1.80
Wanship	13	83	11	32	59.5	......	2	89	23	22	47.5	......
Averages	......	......	......	......	62.3	2.05	......	......	......	......	51.6	1.80

Meteorology of 1866—Continued.

Stations in States and Territories.	SEPTEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	OCTOBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
CALIFORNIA.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
San Francisco	30	69	1	53	57.7	0.07	9	77	21	49	58.6	0.00
Sacramento	2	92	17,25,28	58	72.2	0.00	1	94	21	46	65.2	0.00
Monterey	1	74	23	55	61.8	0.02	30	77	14	47	58.2	0.00
Averages					63.9	0.03	......	......	......	......	60.7	0.00
OREGON.												
Corvallis	9	90	29	42	......	......	1, 2, 3	78	15	30	......	......
Albany	......	......	......	......	......	......	......	......	......	......	......	2.80
WASHINGTON TER.												
Neeah Bay	12	68	27, 28	42	53.5	2.50	......	......	......	......	......	......
MONTANA TER.												
Helena City	12	82	9	36	58.2	1.80	3	82	17	24	48.8	2.61

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MAINE.												
Steuben	16,20,21	52	26	9	......	5.76	......	......	......	......	......	......
Lee	......	......	......	......	......	......	24	49	30	0	26.0	2.59
Barnard	30	55	26	17	34.2	4.21	24	46	31	—13	23.2	2.99
West Waterville	8, 30	57	26	20	39.0	2.64	5	48	30	— 9	25.6	2.37
Gardiner	30	57	26	16	39.1	3.18	5	48	30	— 8	25.5	3.00
Lisbon	......	......	......	......	......	3.76	......	......	30	—14	......	3.55
Webster	16, 30	55	24, 26	10	37.1	......	4	50	30	—14	23.5	......
Standish	......	......	......	......	......	......	4	50	29	0	21.8	2.55
Rumford Point	29	61	25, 26	18	37.3	4.38	5, 7, 9	45	21, 31	—10	21.7	3.75
Cornish	29	63	26	13	35.0	3.28	7, 24	48	21	— 9	23.8	3.66
Cornishville	29	62	26	17	37.1	3.58	24	49	20, 21	— 2	24.9	4.06
Averages	......	......	......	......	37.0	3.85	......	......	......	......	24.0	3.17
N. HAMPSHIRE.												
Stratford	16	58	26	12	34.5	4.60	24	44	21	—22	19.1	1.81
Shelburne	7, 20	54	26	16	......	......	......	......	......	......	......	......
North Barnstead	9	67	26	18	42.4	4.45	......	......	......	......	......	......
Concord	29	67	26	12	40.4	3.33	5	56	21	—16	25.9	2.96
Claremont	29	67	26	11	38.0	1.25	7	49	20, 21	— 8	24.0	4.73
Averages	......	......	......	......	38.8	3.41	......	......	......	......	23.0	3.17
VERMONT.												
Lunenburg	2, 29	68	8, 16, 17	28	46.8	3.25	7	60	29	—20	20.9	1.85
Craftsbury	29	58	26	14	34.6	4.88	4	44	21	—16	19.8	2.25
Randolph	29	60	26	9	36.6	4.08	5	48	21	—28	21.3	2.60
Middlebury	29	60	25	19	39.5	3.67	4	49	21	—13	23.5	2.58
Brandon	......	......	......	......	......	......	7	51	21	—12	25.4	1.87
Barnet	18	56	26	10	37.4	2.75	9	40	20	—20	27.7	1.00
Wilmington	8	58	26	7	37.5	......	7	45	21	—20	22.1	......
Averages	......	......	......	......	38.8	3.73	......	......	......	......	23.0	2.03
MASSACHUSETTS.												
Kingston	8	67	26	20	45.2	3.13	8	58	21	9	33.0	3.02
Topsfield	7	68	26	20	45.3	2.34	4	58	21	6	31.8	2.78
Lawrence	29	66	26	15	40.9	2.43	24	52	21	— 7	29.0	3.16
Georgetown	29	67	26	12	42.7	......	7	53	21	— 6	27.4	......
Newbury	29	68	26	13	40.9	......	7, 24	52	21	— 4	27.8	......

Meteorology of 1866—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
MASSACHUSETTS—Continued.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
North Billerica	29	68	26	8	41.4	......	4	52	20, 22	0	27.1	......
New Bedford	8	64	25, 26	22	43.8	2.55	6	54	21	2	31.7	2.99
Worcester	29	63	26	18	43.3	2.51	7	54	21	— 3	28.2	3.73
Mendon	8, 28, 29	62	5, 26	19	42.2	4.60	8	53	21	— 5	26.1	......
Lunenburg	29	67	26	12	41.5	......	7	51	21	—10	25.5	......
Amherst	9	61	26	17	40.1	3.86	7	51	21	— 4	26.3	3.57
Springfield	29	65	26	17	41.9	3.24	5	56	21	— 6	27.6	3.30
Richmond	10	60	25	22	37.9	6.54	7	50	21	—14	23.5	11.25
Williams College	20	60	26	15	40.2	4.00	4, 7	49	21	—17	23.7	3.80
Averages	......	......	......	......	42.0	3.52	......	......	......	......	27.8	4.18
RHODE ISLAND.												
Newport	8, 9, 10	64	26	20	42.1	4.35	6	55	21	2	30.5	4.35
CONNECTICUT.												
Pomfret	8	62	26	18	40.5	4.22	8	55	21	— 5	28.6	3.55
Columbia	9	72	26	18	46.2	......	8	58	21	— 6	30.3	......
Middletown	9	64	26	17	43.8	4.34	5, 7	55	21	— 5	29.8	3.31
Colebrook	29	67	26	10	38.7	......	6, 7	48	21	—11	23.1	......
Groton	15	68	26	20	45.8	3.68	8	54	21	— 2	31.6	5.28
Averages	......	......	......	......	43.0	4.08	......	......	......	......	28.7	4.05
NEW YORK.												
Moriches	8	71	26	20	48.2	3.34	5, 7	62	21	10	35.3	5.94
South Hartford	9, 29	63	6	19	42.0	4.55	4	53	21	—14	25.1	3.62
Germantown	8	65	26	15	40.5	5.80	7	56	21	—16	26.5	6.30
Garrison's	29	63	26	18	41.5	4.04	4	52	21	— 5	28.0	2.90
Throg's Neck	9	68	24, 25	26	45.4	......	4	58	21	0	30.2	......
White Plains	29	63	26	21	44.7	......	......	......	......	......	......	......
Deaf & Dumb Inst'n	10	64	5	28	45.2	3.84	8	57	21	2	31.7	3.92
St. Xavier's College	8	62	26	27	46.7	2.95	7	55	21	3	33.3	2.47
Columbia College	8, 20	59	26	26	44.9	3.00	4, 7, 8	53	21	3	31.3	3.12
Flatbush	8, 20	61	26	21	44.5	2.89	4, 8	56	20	5	30.9	0.95
Newburgh	8	66	26	25	45.2	3.74	5	59	21	— 3	30.0	2.33
Gouverneur	29	58	25	16	38.2	3.93	4	52	21	—27	21.8	3.76
North Hammond	8, 29	57	25	18	38.8	6.78	4, 8	49	21	—20	21.1	6.11
South Trenton	8	54	25	21	38.6	5.34	8	44	21	—22	23.9	4.10
Oneida	9	69	24	14	39.6	7.36	8	56	21	—26	25.6	3.7[illegible]
Houseville	29	59	25	9	36.2	8.10	4, 8	47	20	—13	21.5	4.01
Depauville	29	58	25	18	39.7	5.17	8	51	21	—18	25.2	4.07
Theresa	......	......	......	......	......	4.86	......	......	21	—27	......	5.16
Oswego	29	59	25, 26	19	40.9	5.92	8	52	21	—15	26.5	7.28
Palermo	29	59	25	11	37.1	6.60	4	57	21	—22	23.4	6.05
Baldwinsville	29	56	26	16	38.6	......	8	52	21	—19	24.7	3.30
Skaneateles	29	57	25	14	37.2	9.50	8	50	20	— 9	25.4	......
Nichols	29	64	25	19	40.2	5.93	7, 8	54	21	—24	26.4	......
Geneva	29	66	23	22	41.7	2.89	7, 8	53	21	— 6	27.3	1.76
Rochester	28	59	6, 25, 26	24	46.7	3.29	8	57	21	—10	27.7	3.22
Rochester Univers'y	8, 28	58	6	21	39.6	3.29	8	54	21	— 9	25.9	3.22
Little Genesee	8, 9, 29	60	6	15	38.9	4.30	8	51	21	—21	23.6	3.23
Friendship	28	68	25	16	38.9	......	8	50	21	—19	24.1	......
Buffalo	10	58	6	23	40.6	3.91	8	54	21	— 5	26.9	6.46
Averages	......	......	......	......	41.4	4.85	......	......	......	......	26.8	4.04
NEW JERSEY.												
Paterson	29	63	26	20	43.7	3.33	4	57	21	— 1	29.6	3.34
Newark	29	63	26	23	45.0	2.09	7, 8	56	21	— 1	30.9	2.91
New Brunswick	29	67	26	22	43.9	2.61	7, 8	55	21	1	30.5	2.83
Trenton	29	66	26	30	48.3	4.30	7	57	21	6	33.7	5.63
Burlington	29	68	26	22	44.8	2.60	5, 7, 8	56	21	2	30.8	4.50
Moorestown	11	66	26	21	44.6	1.83	7, 8	59	21	2	31.5	3.56

Meteorology of 1866—Continued.

Stations in States and Territories.	November. Date.	November. Maximum temperature.	November. Date.	November. Minimum temperature.	November. Mean temperature.	November. Rain or melted snow.	December. Date.	December. Maximum temperature.	December. Date.	December. Minimum temperature.	December. Mean temperature.	December. Rain or melted snow.
NEW JERSEY—Con.												
		Deg.		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
Mount Holly	29	69	26	21	45.2	......	8	62	21	4	32.7	......
Dover	29	69	25, 27	33	49.2	0.79	8, 24	58	20	3	34.6	3.42
Readington	8	75	26	22	47.9	......	8	60	21	— 1	30.9	4.45
Haddonfield	29	69	26	23	45.4	1.82	7	57	21	2	31.7	3.43
Greenwich	29	66	26	23	46.2	1.62	7, 8	57	21	5	33.2	2.53
Averages	......	......	......	......	45.8	2.33	......	......	......	......	31.8	3.[illegible]
PENNSYLVANIA.												
Nyces	8, 9	65	25	10	37.5	6.20	5	59	21	—24	23.7	2.40
Fallsington	29	68	26	24	46.0	1.90	7	58	21	4	32.3	3.1[illegible]
Philadelphia	29	70	26	30	47.4	1.47	8	61	21	6	34.3	3.[illegible]
Germantown	29	66	26	21	45.1	......	7	64	21	0	28.2	......
Horsham	29	69	26	23	44.7	2.42	7, 8	57	21	0	30.4	2.68
Dyberry	8, 9, 10, 13, 29	60	26	10	37.8	......	5, 7	48	21	20	23.9	......
North Whitehall	29	60	26	20	41.9	......	6, 7	54	21	—12	28.6	......
Parkesville	11	65	26	22	43.9	2.25	8	57	21	2	30.9	2.91
Stevensville	29	64	26	18	40.6	3.58	7	55	21	—24	27.1	2.61
Reading	29	70	26	26	45.3	......	8	59	21	3	31.7	......
Ephrata	8, 10	70	26	22	46.0	3.45	7	76	21	0	31.0	2.90
Mount Joy	12	67	24, 25	32	46.6	1.50	8	59	21	7	32.2	2.[illegible]
Harrisburg	29	62	26	28	46.4	3.27	8	57	21	7	31.9	2.06
Lewisburg	29	63	26	19	40.6	4.60	8	55	21	—21	25.6	2.[illegible]
Tioga	9	64	25, 26, 27	18	39.0	4.25	8	60	21	—26	26.0	2.40
Pennsville	29	60	26	16	37.9	4.22	8	51	21	— 8	22.8	3.84
Connellsville	28	71	6	19	41.3	......	5, 8	54	20, 21	— 4	26.8	......
New Castle	28	64	7	26	43.6	......	8	57	21	— 1	27.9	......
Canonsburg	28	68	6	18	41.2	3.44	8	57	21	— 8	26.1	3.13
Averages	......	......	......	......	42.8	3.27	......	......	......	......	28.5	2.75
DELAWARE.												
Delaware City	......	......	......	......	......	......	4, 6, 7, 8	56	21	8	32.3	......
MARYLAND.												
Woodlawn	8	69	26	25	46.6	2.75	5	68	21	4	32.8	2.9[illegible]
Catonsville	3, 17	66	26	28	46.5	1.50	8	60	21	6	30.6	......
Annapolis	29	65	7	27	47.6	3.72	8	66	21	11	36.5	3.94
Emmittsburg	2	68	26	20	46.3	......	7	62	21	— 6	29.7	......
Averages	......	......	......	......	46.8	2.66	......	......	......	......	32.4	3.4[illegible]
WEST VIRGINIA.												
Cabell C. H.	......	......	......	......	......	......	6, 7	62	29	7	34.3	1.30
Romney	2	70	26	20	41.4	......	5	64	21	— 4	28.7	......
Averages	......	......	......	......	41.4	......	......	......	......	......	31.5	1.30
NORTH CAROLINA.												
Wilson	28	75	26	29	50.6	2.45	7, 8	74	21	17	41.5	2.[illegible]
Oxford	29	63	26	36	53.5	......	8	70	21	17	38.6	......
Raleigh	28	75	24	30	49.2	2.83	6, 8	70	28	12	37.0	3.[illegible]
Statesville	3, 4	70	7, 18, 26	22	44.2	5.50	78	64	29	10	35.5	4.[illegible]
Averages	......	......	......	......	49.4	3.59	......	......	......	......	38.2	3.4[illegible]
GEORGIA.												
Atlanta	2	76	25	19	46.6	4.46	7	66	[illegible]	16	36.5	4.[illegible]

Meteorology of 1866—Continued.

Stations in States and Territories.	NOVEMBER.						DECEMBER.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
ALABAMA.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Moulton	3, 4	75	25	28	51.7		......	......	......	......	......	1.73
Bon Secour	5	82	24, 25	37	59.5	......	24	74	12	28	54.4	5.35
Green Springs	5	79	25	28	53.0	4.37	6	78	11	20	43.7	4.99
Averages	......	......	......	......	54.7	4.37	......	......	......	......	49.1	4.02
FLORIDA.												
Fernandina	......	......	......	......	......	......	6, 7	72	12, 28	30	50.2	2.60
Gordan	......	......	......	......	......	......	6	89	28	27	46.8	......
Averages	......	......	......	......			......	......	......	......	48.5	2.60
TEXAS.												
Austin	18	83	30	36	62.3	4.81	2	78	30	30	51.8	1.40
Kaufman	......	......	......	......	......	......	3, 7	79	15	31	53.0	......
Averages	......	......	......	......	62.3	4.81	......	......	......	......	52.4	1.40
MISSISSIPPI.												
Grenada	27	60	25	29	......	......	......	......	......	......	......	......
Fayette	9	75	30	32	54.0	......	5	66	11, 30	24	47.1	......
Natchez	9	76	30	31	56.4	6.94	5, 22, 23, 26	72	30	25	50.3	6.23
Kingston	4	77	30	41	59.1	......	4	78	30	28	49.4	......
Averages	......	......	......	......	56.5	6.94	......	......	......	......	48.9	6.23
ARKANSAS.												
Helena	3	78	30	29	53.7	4.75	23	70	10, 29	23	47.5	11.09
Port Smith	......	......	......	......	......	......	22	70	30	18	41.1	......
Averages	......	......	......	......	53.7	4.75	......	......	......	......	44.3	11.09
TENNESSEE.												
Tusculum College	28	68	1, 26	26	44.5	......	6	64	29	12	35.4	......
Lookout Mountain	3	77	24	29	49.1	......	7	61	30	12	35.7	......
Clarksville	3	77	25	28	48.9	4.72	7	64	30	13	37.4	3.71
Averages	......	......	......	......	47.5	4.72	......	......	......	......	36.2	3.71
KENTUCKY.												
Louisville	2, 3	66	25	22	45.5	4.82	6	60	30	— 2	34.5	3.01
Chilesburg	2	68	25	26	45.2	6.63	7	60	29	6	33.0	2.82
Danville	4	72	25	24	46.4	3.76	7	65	30, 31	9	36.0	3.08
Averages	......	......	......	......	45.7	4.74	......	......	......	......	34.5	2.97
OHIO.												
New Lisbon	9	65	26	20	41.1	2.56	4, 7, 23	55	21	— 4	23.9	3.62
East Fairfield	9, 28	58	26	23	40.8	2.82	8	55	21	0	26.2	3.25
Steubenville	28	67	26	25	43.9	......	8	54	21	7	29.0	......
Milnersville	28	64	6	17	38.3	3.38	5	56	28	— 3	26.2	3.34
Cleveland	28	62	26	30	43.1	......	8	60	20, 21	4	27.3	......
East Cleveland	8	61	6	23	41.6	3.04	8	58	20	— 2	27.6	2.63
Gallipolis	28	70	6, 7, 26	26	44.2	3.41	7	58	28	6	30.1	1.82
Kelley's Island	8	59	24, 30	31	43.4	3.48	7	53	30	8	29.0	2.23
Norwalk	7, 9, 27	60	6	24	41.1	3.10	4	55	30	— 2	27.9	2.25
Westerville	7	59	25	25	42.0	4.52	5, 6	54	30	— 6	30.0	0.87
Kingston	2	66	6	25	42.4	2.78	7	57	30	— 2	28.4	2.30
Toledo	8	61	23	25	40.6	3.13	8	53	30	3	27.4	2.56
Marion	9	58	6, 25	24	39.8	4.17	4, 5, 7, 8	49	30	— 4	26.0	2.89

Meteorology of 1866—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
OHIO—Continued.		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Kenton	9	75	25	32	48.9	8.43	4	62	30	— 4	30.0	6.04
Urbana University	28	59	25	23	40.8	3.27	7	52	30	— 9	26.5	2.11
Hillsboro'	28	61	6, 25, 30	28	41.9	3.35	7	55	30	— 1	27.4	2.62
Ripley	......	......	......	......	......	......	5	59	28	10	33.6	1.75
Bethel	8	62	23	22	41.0	4.39	5	56	30	— 5	27.0	3.38
Cincinnati	8	61	25	26	43.9	3.06	7	57	30	7	30.0	1.99
College Hill	3, 9	56	30	26	42.6	5.50	7	56	30	0	28.2	1.86
Farm School	8	56	12, 25	25	40.8	3.15	6	59	30	— 2	28.3	2.98
Averages	......	......	......	......	42.1	3.75	......	......	......	......	28.1	2.66
MICHIGAN.												
Monroe City	8	58	7	24	30.8	2.75	9	50	30	4	28.6	2.73
State Agric. Coll	9	57	25	18	37.9	2.60	8	52	14	6	25.5	1.90
Litchfield	7	58	23, 24, 25	18	37.1	4.75	7	49	18	2	22.4	2.80
Grand Rapids	7, 9	56	6, 25	23	37.7	8.70	8	47	14	— 6	23.2	2.66
Kalamazoo	......	......	......	......	......	......	2, 4, 5	58	14	4	24.1	......
Northport	8	58	5, 23, 25	26	37.6	......	7	52	21	7	24.0	......
Alpena	......	......	......	......	......	......	8	44	10, 20	10	24.8	0.88
Holland	7	59	6	21	38.5	2.01	3	47	14	2	27.0	5.24
Ontonagon	7	64	4, 5, 24, 30	26	35.8	......	2	48	30	— 9	21.6	......
Homestead	8	57	25	19	37.4	......	7	45	15	— 6	24.6	......
Averages	......	......	......	......	37.7	4.16	......	......	......	......	24.6	2.71
INDIANA.												
Richmond	2	57	25	23	40.0	3.47	7	54	30	— 9	26.2	3.14
Aurora	2	64	12	26	42.7	3.26	6, 7	56	30	— 2	28.2	3.09
Vevay	8	64	25	27	45.3	4.22	5	60	30	5	31.9	3.09
Muncie	10	57	25	22	40.7	4.85	7	53	30	— 2	26.8	3.60
Spiceland	2	58	25, 30	24	41.5	4.20	5	54	30	— 6	27.1	4.00
Columbia City	28	62	24	23	39.8	3.60	5, 6	50	30	— 2	26.0	2.38
Indianapolis	......	......	......	......	......	......	7	54	28	— 1	27.6	......
Merom	3	63	29	23	43.6	3.20	5, 7	57	30	4	29.8	3.55
New Harmony	3	75	25	25	46.3	3.18	7	60	30	5	34.2	3.48
Averages	......	......	......	......	42.5	3.75	......	......	......	......	28.6	3.28
ILLINOIS.												
Chicago	1, 8	66	25	20	41.2	......	2	50	13	0	26.1	......
Evanston	8	63	25	22	40.2	1.01	......	......	......	......	......	......
Marengo	8, 19	60	24	17	37.1	2.75	......	......	......	......	......	......
Riley	......	......	......	......	......	......	2, 3	46	12	— 6	20.8	3.54
Golconda	9	85	23	26	48.7	3.20	8	72	27	10	35.3	3.48
Aurora	9	63	24, 25	20	38.7	0.94	6	47	30	— 4	22.4	3.30
Sandwich	7	63	25	18	36.8	0.28	2	49	30	— 8	22.5	3.16
Ottawa	1, 7	66	24, 30	26	41.7	0.90	2	54	27	5	26.7	2.37
Winnebago	7	63	24	16	37.2	0.59	2	48	30	— 6	20.9	3.84
Hennepin	7	66	24, 25	23	40.0	......	......	......	......	......	......	......
Magnolia	......	......	......	......	......	......	4	60	17, 27, 30	— 2	22.3	3.91
Rochelle	7, 8	63	24	17	39.2	......	2	50	30	— 6	23.3	......
Wyanet	9	75	24	19	40.5	0.24	4	52	30	— 1	25.0	3.60
Tiskilwa	7, 8, 9	60	24	20	39.7	......	2, 4	58	27	1	25.8	......
Elmira	7	64	30	18	40.0	0.35	2, 5	52	12, 27	— 3	23.4	2.12
Peoria	1, 7	63	30	22	42.6	0.51	2	54	27	3	28.2	2.05
Springfield	3	70	24	26	45.8	......	4	62	27	7	30.7	......
Loami	1	66	30	19	41.3	0.40	2	56	12	2	28.7	1.70
Waterloo	......	......	......	......	......	......	7	67	27, 30	14	37.2	......
Dubois	3	72	29	20	39.7	3.70	4	53	30	3	27.8	3.05
Galesburg	8	65	30	17	40.0	0.48	2	51	17, 27	0	25.1	1.54
Manchester	3	69	30	23	43.2	0.50	2	60	12, 17, 27	6	30.3	2.03
Mt. Sterling	1, 9	68	24, 29	20	43.6	......	2	62	27	2	29.0	......
Andalusia	1, 8, 9	69	20	18	40.7	......	4	54	17	6	28.3	......
Augusta	8	66	24	21	43.2	0.51	2	53	17	2	29.4	2.86
Averages	......	......	......	......	41.0	1.09	......	......	......	......	26.9	2.91

Meteorology of 1866—Continued.

Stations in States and Territories.	NOVEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	DECEMBER. Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
WISCONSIN.												
		Deg.		Deg.	Deg.	In.		Deg.		Deg.	Deg.	In.
Manitowoc	8	59	25	23	38.8	1.62	3, 6, 7	45	30	— 3	23.5	1.07
Plymouth	8	60	25	17	36.8	1.30	3, 7	45	30	— 9	21.0	1.90
Milwaukee	8	61	25	20	39.9	1.44	3, 6	47	30	— 7	23.9	2.90
Delavan	8	60	24	18	36.8	0.41	2	47	12, 30	— 8	21.1	2.64
Waupacca	7, 8	60	24, 30	19	37.6	......	2	49	29	— 6	21.4	......
Embarrass	7, 9	62	25	15	35.6	3.07	2, 7	42	30	—14	14.6	1.74
Rocky Run	8	66	24	16	36.7	1.38	2, 3, 4	44	30	—11	20.1	1.06
Beloit	8, 9	54	24	18	36.2	2.85	2	45	11, 12	— 2	21.3	1.60
Baraboo	7	62	24	18	39.1	......	2	56	30	— 6	23.4	1.38
Averages	......	......	......	......	37.5	1.72	......	......	......	......	21.1	1.79
MINNESOTA.												
Beaver Bay	9	53	30	1	31.7	0.80	3	43	29	—15	14.9	0.39
Afton	......	......	......	......	......	......	7	49	29	—14	17.4	......
St. Paul	7	55	30	— 1	32.6	3.19	7	43	29	—13	16.8	0.50
Minneapolis	9	57	30	3	33.7	3.00	7	52	29	—14	17.4	0.33
Sibley	8	59	30	2	34.2	2.32	22	46	29	—16	16.4	......
New Ulm	8	62	30	2	36.0	1.33	7, 22	46	29	—11	19.3	0.24
Averages	......	......	......	......	33.6	2.13	......	......	......	......	17.0	0.37
IOWA.												
Clinton	9	66	30	20	40.4	0.50	2, 4	50	12, 17, 27, 28	0	25.2	3.50
Lyons	9	66	24, 30	22	......	0.47	6, 7	44	28	— 2	22.3	4.30
Davenport	7	62	30	14	39.7	0.52	2, 4	47	27	— 1	23.0	4.16
Dubuque	1	63	30	18	35.2	0.99	4	47	12	0	22.6	1.20
Monticello	1	66	24, 30	18	37.5	1.45	5	55	17	6	23.4	2.15
Burlington	8	68	30	18	40.8	......	2	52	17	— 1	25.5	......
Fort Madison	1	65	24	18	40.0	0.84	2	52	12	1	26.1	2.48
Guttenberg	1	68	24, 30	10	35.4	......	4	46	12	—10	19.7	......
Ceres	1	64	24	13	37.5	......	3	55	12	— 4	21.5	......
Manchester	1	66	24	13	34.4	0.95	4	47	12	— 8	......	......
Mt. Vernon	7	62	24	15	37.6	......	4	49	11, 12	— 6	21.4	......
Iowa City	1	72	24	16	40.2	1.51	4	53	11	— 2	23.6	3.54
Independence	1	68	24	10	39.3	2.60	3, 4, 6, 22	48	29	—10	19.2	2.00
Waterloo	1	66	25, 30	19	36.0	......	3, 6	48	12, 26, 27, 28	0	20.0	......
Osage	9	59	30	16	36.8	......	1	55	29	— 8	19.5	1.40
Iowa Falls	2	60	30	14	38.0	0.98	2, 3, 6	44	11, 29	— 4	21.6	1.03
Des Moines	1	69	30	12	41.3	......	4	51	27	— 2	23.7	1.63
Algona	8	64	29, 30	12	34.5	......	22	48	29	—10	19.6	......
Fontanelle	1	70	30	9	38.7	0.75	4	51	11, 12, 27	— 1	22.0	1.64
Averages	......	......	......	......	38.0	1.05	......	......	......	......	22.2	2.42
MISSOURI.												
St. Louis	3	73	30	25	45.6	1.37	2	55	12, 27	11	33.5	1.87
St. Louis University	3	73	30	27	46.5	1.24	2	56	27	11	34.5	1.85
Allenton	3	77	25	17	43.2	1.48	4	57	30	— 1	31.1	2.78
Union	3	81	23, 30	20	45.5	1.11	5	57	17, 29, 30	8	34.0	2.05
Rolla	3	79	30	18	46.1	0.58	22	60	29	4	34.4	1.10
Edinburg	1	68	30	13	42.1	3.00	3	58	11	5	29.3	2.28
Harrisonville	3, 4	76	30	17	44.3	2.89	5	56	27, 29, 31	8	30.0	3.23
Easton	4	79	29, 30	16	44.9	1.21	......	......	......	......	......	......
Averages	......	......	......	......	44.8	1.61	......	......	......	......	32.4	2.17
KANSAS.												
Leavenworth	4	77	30	14	43.3	2.24	2	59	29	— 4	28.2	2.92
Olatha	3	77	24, 30	16	32.1	3.85	2	59	29	4	28.9	3.40
Atchison	6	71	30	17	43.3	4.40	......	......	......	......	......	......

Meteorology of 1866—Continued.

Stations in States and Territories.	November.						December.					
	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.	Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain or melted snow.
KANSAS—Contin'd.		*Deg.*		*Deg.*	*Deg.*	*In.*		*Deg.*		*Deg.*	*Deg.*	*In.*
State Agricultural College.	4	81	24, 29	20	46.4	1.37	......	......	......	......	......	......
Council Grove.....	4	78	29	23	47.0	1.35	2	60	31	4	32.4	1.90
Averages......	......	......	......	......	42.4	2.64	......	......	......	......	29.8	2.51
NEBRASKA.												
Elkhorn...........	6	70	30	10	39.7	......	4	61	29, 31	0	23.7	......
Bellevue	2, 6, 7, 8	64	29	15	43.6	1.33	3, 4	50	31	4	26.9	1.51
Glendale	1, 6	74	30	6	38.8	1.15	1	57	11	— 1	23.3	1.60
Averages......	......	......	......	......	40.7	1.24	......	......	......	......	24.6	1.56
UTAH TERRITORY.												
Gt. Salt Lake City.	3	72	29	28	45.2	2.25	21	52	5, 10	22	38.3	4.56
Wanship	1, 2	69	13	16	38.1	......	......	......	......	......	......	......
Averages......	......	......	......	......	41.7	2.25	......	......	......	......	38.3	4.56
CALIFORNIA.												
San Francisco	2, 3	61	29	48	54.5	2.90	26, 27	62	7, 10, 14	48	54.5	13.13
Sacramento	1	74	28	37	53.8	2.43	9	68	5, 8	36	50.2	9.51
Monterey	22	68	12, 13	42	52.0	2.33	8	67	5	43	54.7	6.86
Meadow Valley....	......	......	......	......	......	8.75	......	......	......	......	......	......
Averages......	......	......	......	......	53.4	4.10	......	......	......	......	53.1	9.83
OREGON.												
Corvallis	10	66	13	32	......	......	1	60	9	29	......	8.22
Albany.............	......	......	......	......	......	4.88	......	......	......	......	......	......
MONTANA TER.												
Helena City	1	62	28	20	41.7	0.60	6	45	31	—10	25.7	1.00

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